BUSCHKE'S RESTRICTED REMINDING PROCEDURE AS A CLINICAL TEST OF LONG-TERM VERBAL MEMORY

By

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The present study was designed to assess the clinical utility of an experimental verbal memory test designed by Buschke (1973) which has been conceptualized as a test of long-term verbal memory (LTVM) functioning. The study focused on four major issues regarding Buschke's test: 1) the effect of a temporal delay and an additional recall trial on retrieval from long-term memory (LTM); 2) the alternate-form reliability of the test; 3) the concurrent validity of the test; and 4) the test's utility in describing the LTVM deficits of two memory-impaired groups. In order to address these issues, the study utilized 1) a group of 30 S's who were selected due to their having a high probability of verbal memory dysfunction because of chronic alcohol abuse or other probable damage to the left temporal and/or left subcortical areas of the brain and 2) a group of 30 S's who volunteered for the study and had a very low probability of verbal memory dysfunction.

The major results from the study revealed that 1) there was no significant effect on retrieval from LTM when a delay and an additional recall trial was added to Buschke's test; 2) the alternate-form reliability of the test was adequate; 3) the concurrent validity of the test was excellent since 12 of the 13 scores generated from the test were able to differentiate between the memory-impaired group and the memory-intact group and since the scores as a whole were able to classify correctly 93.3% of all the S's; and 4) the test provided detailed information regarding the LTVM deficits of the chronic alcohol abuse group and the left temporal damaged group.

These results were discussed in relation to 1) the conceptualization of Buschke's test as a test of LTVM functioning, 2) the clinical utility of Buschke's test, and 3) the results from other research on the verbal memory functioning of the two memory-impaired groups.

The conclusion of the study was that Buschke's restricted reminding procedure is a reliable and valid test of verbal memory functioning which can be utilized as a clinical test with clinical populations to provide meaningful data regarding LTVM functioning in terms of the storage and retrieval of verbal information.

CHAPTER I
INTRODUCTION AND REVIEW OF THE LITERATURE

Introduction

The analysis of memory dysfunction has received a great deal of attention, both experimentally and clinically, from psychologists and their associates who have been attempting to understand the complexity of memory functioning. Based upon the extensive research that these individuals have compiled, several basic empirically derived assumptions or generalizations have evolved concerning memory. The first of these assumptions is that there are three major components of memory and memory functioning which are related but independent: 1) sensory registers, 2) short-term memory (STM), and 3) long-term memory (LTM). The second assumption is that 1) two main categories of material or information (verbal or nonverbal) are stored in memory and 2) the type of information determines which neuroanatomical structures within the brain will be utilized for memory storage.

For the purpose of the present investigation, only long-term verbal memory (LTVM) functioning will be dealt with in any depth. This type of memory functioning was chosen because 1) an individual's ability to process and utilize verbal material presented in either the auditory or written mode is directly related to his ability to function productively and competently in society; 2) LTVM functioning is of utmost importance since it allows an individual to recall at a later time verbal information which he has previously learned; and 3) a large patient population (patients with left temporal and/or left subcortical brain damage of various etiologies such as chronic alcohol abuse, head trauma, cerebral vascular accidents, or progressive diseases) is thought to have LTVM dysfunction (Brooks, 1975; Luria, 1973, 1976; Milner, 1970; Weiskrantz and Warrington, 1975).

Due to the importance of LTVM functioning, clinicians who are responsible for the assessment of memory functioning need a test of LTVM functioning which 1) is reliable; 2) can differentiate between individuals with LTVM impairment and those who are functioning normally; 3) can distinguish between short-term verbal memory(STVM) functioning and LTVM functioning; and 4) can provide data regarding an individual's ability to store and retrieve information from LTM. Unfortunately, at present there does not appear to be a clinical test of verbal memory which can provide detailed information concerning an individual's LTVM functioning. The primary reason for this void is twofold: 1) verbal memory tests have typically been designed for the assessment of organicity rather than for the evaluation of verbal memory deficits,and 2) almost all of the clinical verbal memory tests were constructed before the recent advances in the analysis and understanding of verbal memory processes which were provided by information processing theory and were not, therefore, designed to distinguish between STM and LTM or provide a detailed analysis of LTVM functioning (Russell, 1975).

Thus, the development of a clinical verbal memory test which is designed specifically as a test of LTVM functioning is sorely needed. Recently, Buschke (1973) has developed a LTVM test; however, it is still in its experimental stage since Buschke has not established its psychometric properties or its applicability to clinical populations. Therefore, it is the aim of this study to examine the reliability, validity, and clinical utility of Buschke's restricted reminding procedure as a test of LTVM functioning.

Review of the Literature

Three Major Components of Memory

During the past three decades, memory functioning has been the focus of a great deal of experimental and neuropsychological research. This research has laid the groundwork for an empirically based theoretical description of memory processes and memory functioning within an information processing framework, culminating in the present categorization of memory and memory functioning into three major components.

The first major component involves sensory memory stores or sensory registers which are modality-specific as defined by the sensory organ involved and are primarily involved in the storage or registering of auditory, visual, or tactile memory traces. These sensory memory traces are generally regarded as extremely transient (less than one to two seconds) and are thought to disappear through the process of decay or by the masking of subsequent stimuli (Craik and Levy, 1976).

The second major category is referred to as STM. Information from the sensory registers enters into STM through the processes of pattern recognition and attention. The amount of material stored in STM is debatable since different empirical methods for assessing STM capacity have lead to different conclusions. If STM capacity is measured by a memory span technique in which a string of items must be reproduced in their correct order, the STM capacity is typically 7 plus or minus 2 items for digits, 5 or 6 items for words, or as high as 20 items for words forming a sentence (Craik and Masani, 1967). If STM capacity is measured by the recency effect in a free recall paradigm, the STM capacity has been found to range from 2.5 to 4.0 words (Craik and Levy, 1976). Items in STM are thought to be acoustically stored although there is some debate as to whether or not there are other storage processes that code information visually and semantically (Craik and Levy, 1976). Because of the limited capacity of STM, items can only remain in STM if some active processing such as rehearsal of the items is taking place. If this processing is not occurring, the items will be lost from STM in approximately 20 to 30 seconds through either interference or displacement, the primary processes operating in STM forgetting (Erickson, 1977).

The third major category is referred to as LTM. Information from STM is transferred to LTM through various rehearsal strategies which allow the information to be encoded and consolidated in a semantic organizational schema and in a relatively permanent state (Craik and Levy, 1976). Transfer of material from STM to LTM need not take seconds or minutes to occur since some transfer begins to take place as soon as material is thought about at all. Consequently, in immediate retention tasks in which the subject is required to recall material immediately after presentation, the retrieval of information can be from both STM and LTM since it is quite possible that the information is being shared by STM and LTM. Moreover, it is possible for a similar type of sharing to occur between STM and LTM in tasks in which the stimulus material is re-presented at the beginning of each trial before recall is initiated. However, in delayed retention tasks in which the subject is required to recall information following a temporal delay (generally 30 seconds or longer) after the presentation of the stimulus material, it is assumed that the retrieval of information will be from LTM. This assumption holds primarily when continuous rehearsal of the information has been inhibited by some technique such as the use of a distractor task, thereby preventing the material from being maintained in STM (Craik and Levy, 1976). Once information has been transferred to LTM, no active processing is thought to be needed for the information to be retained in LTM. Therefore, information that is in LTM is not thought to be lost once it is stored; forgetting of information in LTM is thought to result from either a retrieval failure or interference (Erickson, 1977). Thus, while information quickly disappears and is lost from STM without some active processing, it is permanently stored in LTM and is, therefore, less easily forgotten.

Neuroanatomical Basis of STM and LTM

The possible location within the brain of both STM and LTM has been the focus of considerable research. The research of some investigators (e.g., Kimura, 1963; Luria, 1973, 1976; Milner, 1967, 1968, 1970) has suggested that both memory stores are located within the temporal lobes and their attendant subcortical structures such as the hippocampus, the mammillary bodies, the fornix, and the cortex of the cingulum. These researchers and others (e.g., De Renzi, 1968; Fedio and Mirsky, 1969) have also suggested 1) that memory storage is organized according to the nature of the material (verbal or nonverbal) regardless of the modality (e.g., visual or auditory) and 2) that in the vast majority of individuals the left temporal lobe and attendant subcortical structures are primarily involved in mediating the learning and retention of verbal material while the right temporal lobe and attendant subcortical structures are primarily involved in mediating the learning and retention of nonverbal material. It is thought that approximately 96% of all right handers have this type of cerebral organization (Penfield and Roberts, 1959) and that perhaps as high as 80% of all left handers have at least partial verbal mediation via the left temporal/left subcortical areas (Satz, in press).

The research of other investigators (e.g., Butters, Samuels, Goodglass, and Brody, 1970; Samuels, Butters, and Goodglass, 1971; Samuels, Butters, and Fedio, 1972) has questioned the idea of left temporal mediation of verbal material and right temporal mediation of nonverbal material. This research suggests that this assertion may be true of LTM but that it does not hold with STM. It has found that STM may be modality-specific rather than material-specific since verbal material auditorially presented via a Peterson-Peterson distractor task appeared to be stored in the left temporal lobe while both verbal and nonverbal material presented visually via a Peterson-Peterson distractor task appeared to be stored in the right parietal region.

This research project which will focus on verbal information presented auditorially will not be affected by this controversy since the above investigators agree that both the short-term and long-term memory processing of verbal information auditorially presented is mediated by the left temporal lobe and its attendant subcortical structures.

Verbal Memory Deficits in Relation to Brain Damage to the Left Temporal and/or Left Subcortical Region

The mediation of verbal memory functioning by the left temporal region and its attendant subcortical structures in the great majority of individuals has been empirically supported by studies investigating damage to these areas of the brain. Many researchers (e.g., Brooks, 1972, 1974b; Inglis, 1970; Luria, 1973, 1976; Milner, 1958, 1970; Russell and Nathan, 1946; Schacter and Crovitz, 1977; Winocur and Weiskrantz, 1976) have documented the verbal memory deficits caused by left temporal lobe excision, epileptogenic lesions in the temporal lobe areas, Electroconvulsive Shock Therapy (ECT) involving the temporal structures, acute illness (such as encephalitis and meningitis) and progressive diseases (such as the dementias) which often affect these areas, and head trauma since it affects both the hippocampal mesocortex and the temporal neocortex (Ommaya and Gennarelli, 1974). Typically, the verbal memory deficits have simply been referred to in general, global terms; however, more recently experimental analyses of the verbal memory deficits have revealed that both STVM and LTVM functioning may be adversely affected by damage to these areas of the brain (Brooks, 1975; Luria, 1973; Milner, 1970).

Verbal memory deficits have also been associated with chronic alcohol abuse. Chronic alcohol abuse in combination with vitamin B_1 deficits (a typical nutritional deficit which often accompanies chronic alcohol abuse) affects the mammillary bodies and other mesocortex structures such as the terminal portions of the fornices (Bennett, 1977; Dreyfus, 1974; Victor, Adams, and Collins, 1971). Consequently, severe chronic alcohol abuse which culminates in the onset of Korsakoff's syndrome has been found to be associated with verbal memory deficits in general (Talland, 1965; Inglis, 1970) and may be associated with STM and LTM encoding and storage deficits (Butters and Cermak, 1975; Cermak, Butters, and Gerrein, 1973; Fuld, 1976) or with LTM retrieval deficits (Fuld, 1976; Weiskrantz and Warrington, 1975). Less severe chronic alcohol abuse which has not culminated in Korsakoff's syndrome has also been found to be associated with verbal memory deficits. These deficits have been noted particularly in those patients who are tested after one week or less of abstinence (Ellenberg, 1975; Jonsson, Cronholm, and Izikowitz, 1962; Sharp, Rosenbaum, Goldman, and Whitman, 1977; Weingartner, Faillace, and Markley, 1971) and in other patients tested up to three weeks following withdrawal from alcohol (Binder, 1976). However, the permanency of these verbal memory deficits is debatable since other investigators have reported few to no verbal memory deficits in less severe chronic alcoholics who have maintained sobriety for two weeks or longer (Allen, Faillace, and Reynolds, 1971; Allen, Faillace, and Wagman, 1971; Butters, Cermak, Montgomery, and Aldinolfi, 1977; Parsons and Prigatano, 1977).

Clinical Tests of Verbal Memory

Various tests of verbal learning and verbal memory have been utilized by clinicians since the 1940's. These include the Logical Memory Test and the Associate Learning Test of the Wechsler Memory Scale (Wechsler, 1945), the New Word Learning and Retention Test (Shapiro and Nelson, 1955), the Modified Word Learning Test (Walton and Black, 1957),the Synonym Learning Test (Kendrick, Parboosingh, and Post, 1965), Williams' revised version of the Modified Word Learning Test (Williams, 1968), and the Inglis Paired-Associate Tasks (Inglis, 1957, 1959a, 1959b). As was stated in the introduction, these tests 1) were typically designed to assess organicity rather than to evaluate the nature of a patient's verbal memory deficits and 2) were almost all developed during a time when little was known about the complexity of verbal memory functioning. Consequently, the stimulus parameters and test construction may not allow for a differentiation between STVM and LTVM or an in-depth analysis of LTVM functioning.

Because many of these tests still retain widespread popularity and usage in clinical practice, a critical analysis of these tests in terms of their psychometric properties and data that they provide regarding LTVM functioning appears warranted. Thus, the following review of these tests will explore each test's reliability, validity, range of scores and level of difficulty, and construction with regards to the information it provides concerning LTVM functioning.

In terms of reliability, the tests will be evaluated according to their alternate-form reliability. This type of reliability instead of test-retest reliability is necessitated in memory testing since the materials presented at one testing may still be remembered at the next testing. The establishment of the reliability of a test is important because the reliability of a test places a ceiling on the validity of a test since a test cannot be valid without being reliable (Schepers, 1972). Therefore, the reliability coefficients generated by research on the tests' reliability will be presented in order that the reader may be able to evaluate how closely they approximate .80 since a coefficient of this magnitude or greater is thought to be ideal for clinical tests (Anastasi, 1968).

The validity of the tests will be evaluated in terms of the concurrent validity of the tests since this type of validity is relevant to tests employed for diagnosis of existing status. In general, this type of validity is assessed by determining how well a test is able to differentiate between individuals with a specified diagnosis and individuals without this diagnosis. Ideally, when evaluating the concurrent validity of a verbal memory test, the ability of the test to differentiate between memory-impaired and memory-intact individuals should be assessed. Unfortunately, as will be noted below, the validity of verbal memory tests has often been assessed by evaluating whether they differentiate between organically impaired and nonorganically impaired individuals. This type of assessment of the concurrent validity of a verbal memory test is often inappropriate since there is no reason to believe that all organic disorders of the central nervous system will necessarily cause memory dysfunction (Kear-Colwell, 1973). Consequently, any failure of a verbal memory test to differentiate between organic and nonorganic patients does not necessarily reflect on the validity of the test as a measure of verbal memory functioning.

The range of scores generated by a test and the difficulty of a test will be analyzed since tests with limited ranges or tests which are prone to either ceiling or floor effects are not as capable of providing meaningful data which will aid in the differential diagnosis of memory impairment, especially in those individuals who are only marginally impaired.

The construction of the tests will be evaluated with regards to the information that the tests provide concerning LTVM functioning. The stimulus parameters of the tests (e.g., re-presentation of the stimuli) and the type of recall employed (i.e., immediate or delayed) will be examined to determine if the tests distinguish between STVM and LTVM functioning. If a test is found to distinguish, an analysis will be effected of the specific information provided concerning LTVM (e.g., storage and retrieval of verbal information from LTM).

Verbal subtests of the Wechsler Memory Scale

In 1945, Wechsler developed a memory test battery known as the Wechsler Memory Scale (WMS) which contains two verbal memory tests, the Logical Memory Test and the Associate Learning Test. The Logical Memory Test consists of the free recall of two stories, each containing between 22 to 24 pieces of information depending on whether Form I or Form II of the WMS is used. Each story is read to the patient, and immediately following each story he is asked to recall as much about the story as possible. The score on the test is tabulated by averaging the total number of pieces of information recalled from both stories. The Associate Learning Test is a three trial paired-associate task consisting of a list of ten pairs of words with varying degrees of association between the words in the pairs. Six of the ten pairs are considered to be easy associations since the words in the pairs are typically associated with each other (e.g., up-down, fruit-apple, north-south); the other four pairs are considered to be hard associations since they rarely are associated with each other (e.g., obey-inch, cabbage-pen, crush-dark). After an initial presentation of the ten pairs, the first word in each pair is read to the patient with the patient attempting to supply the second word of the pair. If the patient provides an incorrect word or does not respond within five seconds, the second word of the pair is presented. The second and third trials also begin with a presentation of the ten pairs (with the order of presentation of the pairs being varied) and employ the same associate recall procedure. The score on the Associate Learning Test is obtained by halving the sum of the number of correct responses on all trials on the easy associations and adding this quotient to the total number of correct responses on all trials on the hard associations.

Only two studies were found which analyzed the two forms of these two tests. Stone, Girdner, and Albrecht (1946) analyzed the performance of 87 normal subjects on both Forms I and II of the Logical Memory Test and the Associate Learning Test. The authors stated that there were no significant differences between the scores generated on Forms I and II for either test and concluded that both forms of each test were equivalent in difficulty. Unfortunately, however, no correlations were reported between the alternate forms of either the Logical Memory or Associate Learning tests. Bloom (1959) analyzed the alternate-form reliability of the two tests and reported correlations of .77 for the Logical Memory Test and .61 for the Associate Learning Test. In contrast to the Stone et al. (1946) study, Bloom found that the two forms of the tests were not equivalent as the Logical Memory Test on Form II was slightly easier than the same test from Form I while the Associate Learning Test on Form II was found to be significantly more difficult than the same test from Form I. However, conclusions from Bloom's study must be viewed with caution since the subjects were 32 psychotic patients who, despite the author's claim that they were functioning well, may have had difficulty in performing consistently on both forms due to their impaired thought processes. Thus, the somewhat conflicting results from these two studies and the dearth of available data regarding the alternate-form reliability of these two tests permit the same conclusion that Newman drew in 1953--namely, that the value of these two tests as reliable diagnostic instruments has not been established.

The validity of the Logical Memory and Associate Learning tests has received more experimental analysis although the analyses have attempted to evaluate the tests' ability to differentiate between 1) organic and nonorganic patients, 2) right and left hemisphere damaged patients, and 3) organic and psychotic patients instead of between memory-impaired and memory-intact individuals. In 1950, Cohen analyzed the performance of 144 neuropsychiatric patients (81 nonpsychotics, 45 organics, and 18 schizophrenics) and found that there were no differences among the groups on either the Logical Memory Test or Associate Learning Test. Parker (1957), using a brain-damaged group and a nonbrain-damaged group, Shontz (1957), using a right hemiplegic group and a left hemiplegic group, and Prigatano (1977), using a brain-damaged group and a nonbrain-damaged group, also found that neither test could differentiate between groups. Howard (1950) reported similar negative results in a study of 43 psychotics with organic involvement and 43 psychotics with no organic involvement since he found neither test could differentiate between groups. However, when he separated the Associate Learning Test into easy and hard associations, the organically impaired group did significantly worse on the hard associations. Kljajic (1975) reported mixed results, for he found that the Logical Memory Test was unable to differentiate between a group of 19 organically impaired patients and a group of 18 control patients whereas the Associate Learning Test was able to differentiate between groups. Only Bachrach and Mintz (1974) reported positive results for both tests; they found that both the Logical Memory and Associate Learning Tests could differentiate between a group of 42 psychotic patients with mild cerebral dysfunction and a group of 42 psychotic controls.

Thus, the results from these studies taken as a whole question the validity of both the Logical Memory Test and the Associate Learning Test in differentiating between organic and nonorganic patients, right and left hemisphere damaged patients, and organic and psychotic patients. Unfortunately, while these results are damaging to the tests' utility in a neuropsychological battery which attempts to discriminate between organic and nonorganic patients and to lateralize brain damage, they are unable to provide clinicians with the more important datum of whether they can discriminate between memory-impaired and memory-intact patients. Until this discrimination can be established, these tests should not considered useful clinical verbal memory tools (Erickson and Scott, 1977).

The range of scores generated by the Logical Memory and Associate Learning tests and the level of difficulty of the tests have been found to limit the clinical utility of the tests. The Logical Memory Test has a range from 0 to 23 while the Associate Learning Test has a range from 0 to 21. The ranges of both tests appear to be restricted by the level of difficulty of the tests since on the Logical Memory Test scores above 12 are relatively uncommon (Wechsler, 1945) and on the Associate Learning Test only the most grossly impaired individuals make errors on the easy associations from the three trials (Hall and Toal, 1957). Thus, in actuality, the ranges of both tests are quite restricted and have been found to significantly limit the amount of useful data that either test provides regarding verbal memory functioning (Hall and Toal, 1957).

The construction of the tests with regards to their stimulus parameters severely limits the test' ability to differentiate between LTVM and STVM functioning. The Logical Memory Test presents the stimulus material and has the individual recall the material immediately. With this type of immediate recall procedure, the individual may be utilizing both LTM and STM for retrieval of the information with no way to analyze which memory component is being utilized. The Associate Learning Test not only utilizes this type of confounding immediate recall procedure but also has re-presentations of the stimulus pairs which may allow for some pairs to be maintained in STM due to repetition and rehearsal and prevents a differential analysis of LTVM and STVM functioning. Factor analysis studies support the assertion that neither test differentiates between LTVM and STVM functioning since the tests have been found to load on a factor concerned with both LTM and STM functioning and not on a factor concerned with single memory functioning (Bachrach and Mintz, 1974; Davis and Swenson, 1970; Kear-Colwell, 1973, 1977; Russell, 1975).

In summary, the research that has evaluated the Logical Memory Test and the Associate Learning Test has revealed that 1) the alternate-form reliability of the two tests has not been established; 2) the validity of the tests in regards to differentiating between memory-impaired and memory-intact individuals has not been explored; 3) the tests have restricted ranges; and 4) the tests cannot differentiate between LTVM and STVM functioning.

The New Word Learning and Retention Test

In the mid 1950's, Shapiro and Nelson (1955) devised the New Word Learning and Retention Test (NWLRT) to assess an individual's ability to learn and retain the meaning of new words. In the word learning portion of this test, the individual is required to learn the meanings of five words which he did not previously know as verified by his failure to define them on the Terman-Merrill Vocabulary Test. The examiner repeats the definition of each word prior to the beginning of each trial and then presents the word in order that the individual can supply the definition. A word is considered to be learned when it is correctly defined three consecutive times; after this criterion is met, this word is no longer presented. Unfortunately, there are no guidelines for when testing is discontinued due to the individual's inability to learn the words. In the retention portion of the test, the individual attempts to recall the definitions of the words after a delay of between 25 minutes to 48 hours. An unusual feature of the test in general is that the five words and their definitions vary as a function of the individual's performance on the vocabulary test, thus allowing for different words to be used in the test for different individuals. Moreover, alternate forms of the test are generated by using five additional words that the individual is not able to define.

The psychometric properties of the test with regards to reliability and validity are not well established. There have been no studies that have assessed the alternate-form reliability of the test and only four studies that have assessed the concurrent validity of the test. Three of these studies have compared the test performance of psychiatric patients and normals or psychiatric patients and organically impaired patients in an effort to see if the test can discriminate between these groups. Shapiro and Nelson (1955) compared the performance of 20 normals and 80 psychiatric patients and found that the normals did significantly better on the 24 hour retention portion of the test than did the psychiatric patients while there were no differences reported on the learning portion. Shapiro, Post, Lofving, and Inglis (1956) compared the performance of 102 patients classified as functional (no organic damage), doubtful organic, or organic and found that there were essentially no differences among the groups in terms of their performance on the learning portion of the test or on two retention portions of the test (25 minute delay and 48 hour delay). A similar inability of the test to discriminate between psychiatric and organic patients was reported by Inglis, Shapiro, and Post (1956). The fourth study (Meyer and Yates, 1955) addressed the issue of validity by evaluating the test's ability to detect memory functioning changes in the pre-operation and post-operation performances of eight temporal lobectomy patients (six with dominant temporal lobectomies and two with nondominant temporal lobectomies). The six dominant patients scored significantly worse on both the learning and the 24 hour delay portions of the test following their operations whereas there was no difference in the pre- and post-operation performance of the two nondominant patients. These findings would be expected since the dominant temporal lobe (typically the left) is thought to subserve verbal memory functioning while the nondominant (typically the right) is thought to subserve nonverbal memory functioning. Follow-up data were obtained on four of the dominant patients one year post-operatively and revealed that both the verbal learning and memory deficits were still evident. While this study is vastly superior to the other three in that it used memory-impaired/memory-intact comparisons in a within subject design, its positive findings are not sufficient to establish the validity of the NWLRT. Thus, more research is necessary before the NWLRT can be considered a reliable and valid clinical verbal memory test.

The range of scores generated by the NWLRT in its learning component is unclear due to the lack of guidelines for the number of trials until the test is discontinued without the learning to criterion being met. Consequently, various scoring techniques were devised by the experimenters cited above, and, therefore, various ranges also evolved, dependent upon the idiosyncratic scoring techniques. The range of scores for the retention component is very restricted since it is from 0 to 5; moreover, in reality the upper limit may be even lower than 5 if not all definitions were learned to criterion initially. The difficulty of the test is thought to be subjectively equal for each individual since each individual is required to learn the definitions of five words that he does not already know. However, this assumption has not been investigated and, therefore, has no empirical support. Moreover, the manner in which the test's stimuli are generated prohibits the use of a standardized form.

The stimulus parameters of the learning component of the NWLRT are quite similar to those of the Associate Learning Test of the WMS since the words with their definitions are continually presented to the individual until he is able to correctly define each word three consecutive times. Thus, because of the re-presentation of the definitions, both STVM and LTVM functioning are being evaluated with no method for distinguishing between them. However, the retention component of the NWLRT, ranging from 25 minutes to 48 hours, is clearly superior to either of the verbal subtests of the WMS which have no delay recall component since it allows for a direct analysis of LTVM functioning which cannot be confounded by STVM components. Unfortunately, although the retention portion does allow for a distinction between STVM and LTVM, it does not provide detailed information regarding LTVM functioning since there is only one trial on which LTVM functioning is analyzed.

The Modified Word Learning Test

In 1957, Walton and Black revised the NWLRT and named their revised test the Modified Word Learning Test (MWLT). The major revisions that they enacted were 1) the use of ten new words to be learned instead of five (a revision that they hoped would increase the difficulty of the test and thereby improve the test's ability to detect brain damage in patients); 2) the generation of more specific scoring guidelines in order to help standardize the scoring procedure; and 3) the elimination of the retention interval of the test since they were interested only in immediate verbal learning of material.

The reliability of the test has been assessed by only one study (Riddell, 1962b) which used 22 psychiatric female patients and reported an alternate-form reliability coefficient of .815. The studies which have been done to assess the validity of the MWLT have focused solely upon its ability to differentiate between organic and nonorganic patients. Three studies (Walton, 1958; Walton and Black, 1957; Walton,White, Black, and Young, 1959) found that the MWLT was able to differentiate between groups of organic and nonorganic patients while a fourth study (Newcombe and Steinberg, 1964) found that the MWLT was unable to differentiate between these two groups. The range of scores of the MWLT cannot be derived since specifications for when testing is discontinued if learning to criterion is not effected by the individual were not included in the scoring revisions. The difficulty of the test is slightly improved since twice the number of words are used but still suffers from the same criticism as that posited above for the NWLRT since a standardized form is not used. The stimulus parameters of the MWLT are very similar to those of the learning portion of the NWLRT in that the list of definitions are readministered until the individual achieves criterion. Thus, the same STVM/LTVM confounding exists with the MWLT as with the learning segment of the NWLRT. Unfortunately, by eliminating the retention interval, Walton and Black eliminated any direct, unconfounded analysis of LTVM functioning.

Revisions of the MWLT

The Synonym Learning Test. In 1965, Kendrick, Parboosingh, and Post developed the Synonym Learning Test by making two major revisions of the MWLT: 1) the simplification of the scoring system which sets an upper limit of 10 on the number of trials until the test is discontinued and 2) the use of synonyms for the words instead of definitions. No studies were found on the alternate-form reliability of the instrument. Only one study (Kendrick et al., 1965) has assessed the validity of the test and found that the test was able to differentiate between brain-damaged and nonbrain-damaged individuals. Because of the new scoring system and the new limit on test trials, the range of the test is quite sufficient since it is from 0 to 100. The difficulty of the items on the test, however, suffers from the same problem as that specified for both the NWLRT and the MWLT since the words may be different for each individual. The stimulus parameters of the test have the same confounding of STVM/LTVM components as those of the MWLT since there is a re-presentation of the stimuli before each trial.

Williams' Word-Learning Test. In 1968, Williams revised the MWLT 1) by using a standard list of eight infrequently used words for each subject, 2) by changing the scoring to the number of errors made over five trials, and 3) by using synonyms rather than definitions for the words. Alternate-form reliability of Williams' Word-Learning Test (an alternate list of eight other infrequently used words was used) was found to be .74 (White, Merrick, and Harbison, 1969). The validity of the test has been evaluated by comparing the performance of normal and brain-damaged individuals, brain-damaged and psychiatric patients, psychiatric patients with and without electroencephalogram (EEG) abnormalities, and right and left temporal lobe epileptics. Although Williams (1968) found that the test was able to discriminate between brain-damaged patients and normal controls and between brain-damaged patients and psychiatric patients free of brain damage, other investigators have questioned the test's validity. White et al. (1969) found that the test was unable to differentiate between psychiatric patients with EEG abnormalities and those without EEG abnormalities. More importantly, Reynolds (1974) found that this instrument was unable to differentiate between left temporal lobe epileptics (a group with a high probability of having verbal memory deficits) and right temporal lobe epileptics (a group with a high probability of having no verbal memory deficits).

The range of scores on the test is adequate since it is between 0 and 40, and the level of difficulty of the items appears to be sufficient since the words all are extremely uncommon (e.g., fribble, kermes, gibus, vervaine). Moreover, the use of the same eight words for each individual allows for the generation of norms.

The stimulus parameters of the test are unclear. Since Williams (1968) states that the revisions mentioned above are the only revisions of the MWLT, one must assume that the list of eight words with their synonyms is re-presented at the beginning of each trial although this is not specified in her description of test administration. There is mention of supplying immediately within the trial the correct synonym if the individual fails to respond correctly - an administrative revision which Williams fails to acknowledge. Despite this lack of clarity, a confounding of STVM and LTVM functioning exists since there is, at the least, a re-presentation of the stimuli within the trial.

Summary of the MWLT and its revisions

Thus, several major criticisms can be leveled at the MWLT and its revisions in regards to their utility as verbal memory tests and the data they provide in relation to LTVM functioning. The first criticism is that their alternate-form reliability (with the exception of the Williams' revision) is difficult to assess due to the lack of a standardized first or second form. The second criticism applies to the concurrent validity of the tests. Almost half of the studies reviewed produced results that question the utility of these tests in detecting brain damage since these studies found that the tests were unable to differentiate between brain-damaged and nonbrain-damaged individuals. The more important datum of whether or not they can differentiate between memory-impaired and memory-intact individuals has been addressed only by Reynolds (1974) who reported negative findings. The third criticism is that the tests' stimulus parameters do not permit a differentiation between STVM and LTVM functioning. Thus, the utility of the MWLT and its revisions as tests of verbal memory has not been established.

Inglis' Paired-Associate Task

Inglis (1957, 1959a, 1959b) developed a paired-associate learning test to assess an individual's ability to acquire new associations. While there were various differences among the stimulus parameters of the test as it was being developed (e.g., one form had a visual as well as an auditory presentation; one form had a 30 minute delay after the initial acquisition phase), the form of the test which has been used predominantly has employed an auditory presentation and simple recall procedure of three pairs of words not commonly paired or associated (e.g., flower and spark). With this test, the examiner presents the three pairs of words and then presents the stimulus words in a random order, allowing the individual to supply the other half of the paired-association (i.e., the response word). If the individual responds correctly, the next simulus word is presented; if the individual responds incorrectly or fails to respond within 10 seconds, the response word is supplied by the examiner. The material is presented in this manner until the individual supplies three consecutive correct responses for each stimulus word or until each stimulus word has been presented 30 times. The score on the test is the sum of the number of times the response words are supplied by the examiner before the criterion is reached; therefore, the range of scores is from 3 (the best score) to 93 (the worst score).

The alternate-form reliability of the test has been assessed by Riddell (1962a) who found that there was a correlation of .507 between the two forms and by Newcombe and Steinberg (1964) who reported a correlation of .615. The validity of the instrument has been evaluated by comparing the performance of organic and nonorganic patients and, more appropriately, the performance of memory-impaired and memory-intact patients. Newcombe and Steinberg (1964) and Kendrick et al. (1965) found that the Inglis test was able to differentiate between organic and nonorganic patients. Inglis (1957, 1959a, 1959b) and Caird, Sanderson, and Inglis (1962) found that the test was able to differentiate between memory-impaired and memory-intact elderly psychiatric patients. The memory-impaired patients were selected according to the following criteria: 1) the psychiatrist or other hospital personnel had noted the patient was memory-impaired or 2) the patient or his relatives had complained of the patient's memory problems. While the use of this type of group in research on the concurrent validity of a memory test avoids the problem of utilizing a group of undifferentiated organically impaired individuals who may or may not have memory problems, the use of self-report or the report of a physician or significant other as the sole diagnostic criterion may also be fraught with significant problems since reports of this type may be biased and inaccurate. Consequently, it may have been more appropriate to have used those patients who not only reported memory deficits but also had evidence of brain damage compatible with memory dysfunction. Nevertheless, despite these possible problems with subject selection, the results from these studies demonstrated that Inglis' test was able to differentiate between memory-impaired and memory-intact elderly psychiatric patients.

The range of scores generated by Inglis' test is from 3 to 93. While this range appears to be broad, the restricting of the test to three paired-associates may limit the test's ability to detect memory impairment which is not of a gross nature since the limited difficulty of the test may produce a ceiling effect on the scores generated. The studies done by Inglis (1957, 1959a, 1959b) and by Caird et al. (1962) do not address this issue since these studies used only those patients with severe memory impairment. Therefore, further research on this aspect of this instrument is needed to determine if it can be utilized as a verbal memory test with patients evidencing varying degrees of memory impairment.

The stimulus parameters of the test do not permit a distinction between STVM and LTVM functioning since the examiner re-presents the second word of the pair if the individual fails to respond correctly to the stimulus word. However, it is likely that STVM functioning is the major component assessed since the use of only three pairs may allow the items to be rehearsed and maintained in STM. This assumption has some empirical support since Kendrick et al. (1965) found that the Inglis Paired-Associate Learning Test loaded primarily on a STM factor. Thus, although Inglis' test appears to be a fairly reliable and valid test of STVM functioning with severely memory-impaired patients, it does not appear to provide meaningful data regarding LTVM functioning.

Conclusion: Clinical Tests of Verbal Memory

Based upon the above review of the literature on the clinical tests of verbal memory, it is evident that 1) too little research has been done on their psychometric properties in general, 2) too little research has been done on the alternate-form reliability of the tests, 3) the research on diagnostic or concurrent validity has rarely addressed the important issue of whether the tests can differentiate between memory-impaired and memory-intact individuals, and 4) the tests often have restricted ranges and poor scoring criteria and are prone to ceiling effects, all of which limit their clinical utility. When the tests were evaluated for their ability to distinguish between STVM and LTVM functioning or to provide detailed information concerning LTVM functioning, it was evident that the tests with the exception of the NWLRT were not designed to analyze verbal memory functioning along these dimensions and that the NWLRT provided only the most rudimentary analysis of LTVM functioning. Consequently, Russell's statement (1975) that no commonly used clinical memory tests make a distinction in their design between STM and LTM appears to be supported by the above review of the tests' stimulus parameters.

Although the above clinical tests were not designed either to distinguish between STVM or LTVM or to provide detailed information regarding LTVM functioning, Buschke (1973) has developed an experimental verbal memory test that is specifically designed to assess LTM functioning.

Despite the fact that its psychometric properties and its applicability to clinical populations have not been established, it will be presented in detail because of its unique design and potential for filling a void in LTVM testing.

Buschke's Restricted Reminding Procedure

Buschke (1973) developed a verbal memory test to assess LTM functioning. Although he experimented with the number and type of words to be recalled, the number of recall trials, and the method of presenting the words (Buschke, 1973, 1974, 1975; Buschke and Fuld, 1974), his test typically consists of the free recall of a list of 20 words from a related category (four-footed animals) over a series of 12 trials and utilizes a restricted reminding procedure after the initial recall trial. This restricted reminding procedure consists of re-presenting at the beginning of each trial only those words which have not yet been recalled before the individual attempts to recall all of the words in the list. Therefore, the restricted reminding procedure, which differs from the conventional free recall procedure (reviewed in conjunction with the clinical verbal memory tests) which typically re-presents the entire list of words at the beginning of each recall trial, allows for substantially fewer re-presentations.

The administration of Buschke's test begins with the examiner reading the list of 20 words to the individual at a word per two second rate with the individual attempting to recall in any order as many of the words as possible immediately after the presentation of the list. After the individual has been urged to extend his recall and has failed to respond for a period of at least 10 seconds, the recall trial is terminated. Each subsequent trial begins with the re-presentation of those words not yet recalled before the individual again attempts to recall all the words in the list. Since words are re-presented only until initially recalled, the number of re-presentations diminishes greatly during the first few trials, and by the end of the fourth trial when typically all words have been recalled at least once (Buschke, 1973, 1974; Buschke and Fuld, 1974; Fuld, 1976), there are no further re-presentations. After this point in the test, each recall trial begins with the examiner simply asking the individual to recall as many words as possible from the list and ends when the individual has failed to respond for a period of at least 10 seconds.

The restricted reminding procedure, which limits the number of re-presentations of the words, minimizes the role of STM functioning. A possible STM influence on an individual's performance exists during the first few trials of the test for words that are recalled immediately after initial presentation or after re-presentation since they may be retrieved from STM, LTM, or shared by both. Moreover, a differentiation cannot be made as to whether the recall was from STM, LTM, or both for words recalled after presentation that are not recalled again on a later trial. Therefore, the restricted reminding procedure suffers from an STM/LTM confounding; however, this confounding is minimal since it is thought to occur only until all re-presentations are completed (typically by the end of trial 4) and only for those words during the early trials that are recalled after presentation.

The restricted reminding procedure allows for a distinction between STM and LTM functioning and maximizes the role of LTM functioning in an individual's performance. Since the restricted reminding procedure permits words to be recalled without presentation, it allows for a distinction between STM and LTM functioning. A word recalled without presentation is thought to be recalled from LTM because the verbal interference and temporal delay between its recall on one trial and subsequent recall on a later trial prevent its rehearsal and maintenance in STM. Moreover, it is inferred that the initial recall of this word was from either LTM or from both LTM and STM but not from STM solely since the second recall of the word demonstrated that the word is in LTM and suggests that the word was most probably stored in LTM during its initial recall. Consequently, retrievals from LTM may begin as early as trial 1, consist of any recall without presentation, and, therefore, comprise all recalls after the re-presentations have been discontinued. Thus, the test's stimulus parameters allow for an individual's performance to be analyzed almost exclusively in terms of LTM functioning.

The scores derived from Buschke's test are concerned with analyzing LTM functioning since they assess 1) the number of words stored in LTM, 2) the total number of retrievals from LTM, and 3) the total number of consistent retrievals from LTM. As was stated above, words which are recalled without presentation are thought to be recalled from LTM; consequently, an estimate of the number of words which are stored in LTM is made by summing the number of words which have been recalled at least twice over the 12 recall trials (range from 0 to 20). It is imperative that only those words that are recalled at least twice be included in this estimate since some words that have been recalled only once may have been recalled solely from STM and were, therefore, never in LTM. However, this estimate is a conservative estimate since some words which have been recalled only once may have been stored in LTM but because of a retrieval problem the storage could not be demonstrated. The total number of retrievals from LTM is estimated by summing the total number of correct recalls for any word that is stored in LTM (range from 0 to 240). This total includes the initial recall of those words that are stored in LTM since the initial recalls were most probably from LTM solely or in conjunction with STM. However, this total is only an estimate since those words that are recalled only once may have been retrieved from LTM, STM, or both with no way to differentiate the origin of the retrieval. The total number of consistent retrievals from LTM is analyzed by tabulating the number of words which have been consistently retrieved through the last recall trial (range from 0 to 20). However, since the number of trials of consecutive retrievals has not been specified, the scoring of this category has not been defined. One further score, total recall, has been derived from Buschke's test. Total recall is simply the total number of correct recalls of the words over the 12 recall trials (range from 0 to 240). However, total recall may not be concerned exclusively with LTM functioning since some words may be recalled only once after either initial presentation or re-presentation and, therefore, may be recalled solely from STM. Thus, Buschke's test yields four scores, three of which are concerned exclusively with evaluating the storage and retrieval of verbal information from LTM.

The ranges of scores from the test vary in breadth from 0 to 20 for the total number of words stored in LTM and the total number of words consistently retrieved to 0 to 240 for the total number of retrievals. The range of 0 to 20 appears to be adequate since the difficulty of trying to recall all 20 items at least twice and trying to recall them consistently over a series of trials is probably sufficient so as to prevent the discrimination problems associated with ceiling effects in tests.

The range of 0 to 240 appears to be sufficient since it allows for a great deal of variability of performance between individuals. Thus, because of these ranges and the difficulty of the test, it is highly likely that discriminations can be made not only between severely memory-impaired and memory-intact individuals but also between only mildly impaired individuals and individuals with no memory problems.

The alternate-form reliability of the test has never been established although Buschke did compare the performance of two groups of 10 normal college students on two lists of 20 words (the original animal list and a list of 20 unrelated words). He found no differences between scores for the groups on the two lists and concluded that they were equivalent in difficulty for this restricted sample. The concurrent validity of the test has not been evaluated in any depth. Two studies (Buschke and Fuld, 1974; Fuld, 1976) have analyzed the performance of a total of four memory-impaired alcoholic patients and have found that these patients when compared to controls scored significantly lower in regard to their total recall, total retrieval, consistent retrieval, and number of words stored in LTM.

Thus, although Buschke's test appears to be designed to provide detailed information regarding storage and retrieval from LTM, it cannot be viewed as a clinical test of verbal memory functioning until 1) its reliability and validity can be established, 2) its norms are extended beyond college samples, and 3) its utility in describing memory deficits is extended beyond four patients.

Statement of the Problem and Questions Addressed

The present research project attempted to 1) determine if a temporal delay after the twelfth recall trial affects retrieval on a thirteenth recall trial on Buschke's test; 2) assess the alternate-form reliability of Buschke's procedure; 3) assess the concurrent validity of Buschke's procedure; and 4) determine the utility of Buschke's procedure in describing LTVM deficits within two groups of memory-impaired patients.

Question 1: Effects of a Temporal Delay on Retrieval from LTM

Delayed recall allows for an unconfounded analysis of retrieval from LTM since a temporal delay filled with competing stimuli prevents the rehearsal and maintenance of items in STM. On Buschke's test after the re-presentations have been discontinued, the trials are essentially delayed recall trials since there is a substantial amount of verbal interference and a short temporal delay between recalls from one trial to the next. Therefore, it is assumed that the implementation of an extended temporal delay before a thirteenth recall trial would not significantly affect the number of words retrieved on trial 13 when compared with the number of words retrieved on trial 12. However, this assumption has not been researched and has no empirical support. Consequently, the present study incorporated a 30 minute delay with a distractor task and a thirteenth recall trial and analyzed the effects of this delay on retrieval of words from LTM for both the memory-impaired and the memory-intact groups.

Question 2: Alternate-Form Reliability

Buschke (1974) evaluated the equivalency of an unrelated list and his animal list and found that they were equivalent for two groups of 10 college students. However, his study did not evaluate the reliability of the two forms nor did it employ an adequate heterogeneous sample for such an evaluation. Consequently, the reliability of his test as a clinical instrument has not been adequately assessed. In order to assess the reliability, it was thought that a related list should be developed since the level of difficulty of such a list might more closely approximate the level of difficulty of Buschke's animal list due to the possibility of its being easier to organize and recall than an unrelated list. Therefore, an alternate form was developed by creating a related list (foods) of 20 words which were matched with the 20 list words from Buschke's animal form according to frequency of usage in the English language (see Appendix A) as determined by Thorndike and Lorge (1944). The alternate-form reliability and the equivalency of the two forms were then analyzed for a variety of scores to determine 1) if the reliability coefficients generated were statistically significant and approximated .80 or greater which has been specified by Anastasi (1968) as the ideal coefficient for clinical tests and 2) if the scores from the two forms were equivalent.

Question 3: Concurrent Validity

The literature review on clinical verbal memory tests revealed that many of the studies which evaluated the concurrent validity of these tests used comparisons between brain-damaged and nonbrain-damaged individuals. However, since brain damage per se is not necessarily associated with memory dysfunction, it is more appropriate to evaluate the concurrent validity of a verbal memory test by comparing the performances of memory-impaired and memory-intact individuals. Although Buschke and Fuld (1974) and Fuld (1976) compared the performance of memory-impaired (chronic alcohol abusers) and memory-intact individuals on Buschke's test, the concurrent validity of the test has not been adequately assessed since these comparisons were made on only four pairs of individuals. Therefore, an assessment of the test's ability to discriminate between a larger group of memory-impaired individuals (consisting of chronic alcohol abusers and left temporal and/or left subcortical damaged patients) and memory-intact individuals was effected to evaluate the test's concurrent validity.

Question 4: LTVM Deficits within Two Memory-Impaired Groups

Buschke's test appears to provide detailed information regarding the storage and the retrieval of verbal information from LTM. It has been used to describe the LTVM functioning of four alcoholic patients and has produced data which suggest that alcoholics have deficits both in the long-term storage and retrieval of verbal information (Buschke and Fuld, 1974; Fuld, 1976). However, before any definitive statements concerning its clinical utility in describing LTVM deficits can be made, the test should be used to evaluate a larger, more heterogeneous group of alcoholic patients and a group of memory-impaired patients with organic bases for dysfunction other than chronic alcohol abuse. Therefore, in order to determine its utility in describing LTVM deficits within two memory-impaired groups, comparisons were made between 1) a larger group of chronic alcohol abusers and a group of memory-intact individuals, 2) a left temporal and/or left subcortical damaged group (referred to hereafter as the left temporal damaged group) and a second group of memory-intact individuals, and 3) the chronic alcohol abuse group and the left temporal damaged group. Moreover, the applicability of Buschke's test in describing the LTVM deficits of an individual _S_ was analyzed.

CHAPTER II
METHOD

Subjects

The S's in this experiment were 30 memory-impaired patients who had been referred for neuropsychological evaluation from the Gainesville Veterans Administration Hospital (GVAH) or the Shands Teaching Hospital (STH) and 30 memory-intact individuals who had volunteered for the study.

The 30 memory-impaired patients were selected on the basis of their having a high probability of verbal memory impairment. This selection was based upon two criteria: 1) the patient, a significant other, or a member of the patient's treatment team reported that the patient had memory problems in relation to recently presented verbal material (e.g., something he had read or had been told); and 2) the patient's reported verbal memory problems could be attributed to possible organic impairment of the left temporal and/or left subcortical region of the brain. The memory-impaired group was divided into two subgroups based upon the type of organic impairment: a group of 15 patients who had reported chronic alcohol abuse (an average intake of one pint or more of alcohol a day for a period of at least 10 years extending until the present hospitilization) but who were judged not to have Korsakoff's syndrome since they were able to recall day to day and current events, were oriented in time and space, and had no apparent retrograde amnesia and a group of 15 patients with no history of alcohol abuse who evidenced signs of left temporal and/or left subcortical damage as determined by neuropsychological testing, standard neurological examinations, EEG's, brain scans, and neurosurgical reports.

The chronic alcohol abuse group consisted of 15 patients who 1) were part of an alcohol treatment program at the GVAH, 2) averaged 13.8 years of heavy drinking (range from 10 to 22 years), and 3) were tested on the average of 6.4 days since their last drink (range from 1 to 15 days with 11 patients having 7 days or less of sobriety and the other 4 patients having 9, 14, 14, and 15 days of sobriety). All 15 of the patients were found to have at least one significant medical disorder which was thought to be related to their chronic alcohol abuse. Fourteen of the patients evidenced at least one of the following signs of liver damage: significantly elevated SGPT and SGOT levels, findings of hepatomegaly and ascites, a history of alcoholic hepatitis, and biopsy proved cirrhosis. Six of the patients had other significant medical problems related to their drinking such as gastro-intestinal problems and hematemesis, pancreatitis, possible peripheral neuropathy, and abnormal paroxysmal bursts of theta and delta wave activity over the left temporal region. All 15 patients reported very poor nutritional intake during their severe drinking periods, often going several days without eating. Seven of the patients had been in at least one other inpatient alcohol treatment program prior to entering the program at the GVAH.

The left temporal damaged group consisted of 8 patients who had suffered relatively severe head trauma and 7 patients who had sustained brain damage from varying etiologies. Eight of the 15 patients were patients on the Rehabilitation Ward of the GVAH while the remaining 7 patients had been referred for neuropsychological testing at the STH. The 8 head trauma patients evidenced various sequelae ranging from brief periods of unconsciousness (seconds), severe focal headaches, and abnormal

EEG focal slowing over the left temporal region to prolonged unconsciousness (up to 7 weeks), major motor seizures, and cerebral contusions and subdural hematomas in the left temporal region. These patients were tested on an average of approximately 3.5 years following their accidents (range from 3 months to 11 years). The remaining 7 patients in the left temporal damaged group were categorized as follows: two patients who had sustained penetrating missile wounds which destroyed portions of the left temporal region, caused bleeding in this area, and resulted in right hemiparesis or hemianopsia and in abnormal EEG wave patterns in the left temporal region; two patients who evidenced damage of unknown etiology which was primarily in the left temporal region as documented by neuropsychological and standard neurological evaluation; one patient who had had a series of 8 bilateral ECT treatments which resulted in verbal memory dysfunction; one patient who had experienced a severe viral infection which resulted in diffuse abnormal EEG activity in the left hemisphere including the left temporal region and neuropsychological deficits compatible with diffuse left hemisphere damage; and one patient who had experienced prolonged anoxia (as the result of a myocardial infarction) which resulted in diffuse brain damage, particularly in the left temporal region.

The 30 memory-intact individuals who volunteered for the experiment were selected on the basis of their having a very low probability of having verbal memory dysfunction and consisted of 20 patients and 5 employees from the GVAH and 3 patients and 2 employees from the STH. All 30 individuals reported no verbal memory dysfunction or history of alcohol abuse. Investigation of the medical records of the 23 patients revealed no medical disorders associated with alcohol abuse and no evidence of left hemisphere dysfunction although 3 of the patients were found to have right hemisphere dysfunction. The 7 employees reported no history of severe head trauma or treatment or hospitilizations for cerebral dysfunction. The 30 memory-intact individuals were assigned either to a control group for the alcohol abuse group or to a control group for the left temporal damaged group.

Thus, there were two main groups of S's in the study: a group of memory-impaired individuals and a group of memory-intact individuals. Within each major group, there were two subgroups. Within the memory-impaired group, there was a chronic alcohol abuse group and a left temporal damaged group. Within the memory-intact group, there was an alcohol abuse control group and a left damaged control group.

The memory-impaired group and the memory-intact group, the chronic alcohol abuse group and the alcohol abuse control group, the left temporal damaged group and the left damaged control group, and the chronic alcohol abuse group and left temporal damaged group were equated on the variables of age, education, verbal intelligence (VIQ) as assessed by the verbal portion of the Satz-Mogel short-form (Mogel and Satz, 1963; Satz and Mogel, 1962) of the Wechsler Adult Intelligence Scale (WAIS),[1] race, sex, and handedness. A breakdown of these variables is presented in Table 1. The groups were closely equated on the variables of race, sex, and handedness. No overall difference (analyzed multivariately by the Hotelling T^2 statistic) was found on the variables of age, education, and VIQ

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[1] One memory-impaired patient and his memory-intact control were given the verbal portion of the Wechsler Intelligence Scale for Children because of their ages.

Table 1
Mean Age, Mean Education, Mean VIQ, Race, Sex, and Handedness by Group

Group	n	Age	Education (yr.)	VIQ	Race		Sex		Handedness	
					White	Black	Male	Female	Right	Left
Total Memory-Impaired	30	38.73	13.43	110.53	28	2	27	3	27	3
Total Memory-Intact	30	37.80	12.87	110.87	28	2	27	3	26	4
Chronic Alcohol Abuse	15	39.67	14.47	115.67	14	1	14	1	14	1
Alcohol Abuse Control	15	38.67	13.80	112.33	14	1	14	1	14	1
Left Temporal Damaged	15	37.80	12.40	105.40	14	1	13	2	13	2
Left Damaged Control	15	36.93	11.93	109.40	14	1	13	2	12	3
Chronic Alcohol Abuse	15	39.67	14.47	115.67	14	1	14	1	14	1
Left Temporal Damaged	15	37.80	12.40	105.40	14	1	13	2	13	2

for 1) the total memory-impaired group and the total memory-intact group ($F = .42$; $df = 3,56$; $p \leq .74$); 2) the chronic alcohol abuse group and the alcohol abuse control group ($F = .21$; $df = 3,26$; $p \leq .89$); 3) the left temporal damaged group and the left damaged control group ($F = .82$; $df = 3,26$; $p \leq .50$); and 4) the chronic alcohol abuse and the left temporal damaged group ($F = 1.47$; $df = 3,26$; $p \leq .25$).

Design

The tests given to the S's were arranged in one of two sequences of presentation. Sequence 1 consisted of 1) Buschke's restricted reminding procedure utilizing the animal form, 2) a 30 minute delay period[2] during which the verbal portion of the Satz-Mogel short-form WAIS or a neuropsychological test not involving memory functioning was given, 3) a thirteenth recall trial of the animal form, and 4) Buschke's restricted reminding procedure utilizing the food form. Sequence 2 consisted of 1) the food form of the test, 2) a 30 minute delay period during which the verbal portion of the short-form WAIS or a neuropsychological test was given, 3) a thirteenth recall trial of the food form, and 4) the animal form of the test.

The order of presentation of the two forms was controlled for by having the same number of memory-impaired and memory-intact S's receive Sequence 1 and Sequence 2. Consequently, seven S's in the chronic alcohol abuse group and seven S's in the alcohol abuse control group were randomly assigned to Sequence 1 while the other eight S's in both of these groups were randomly assigned to Sequence 2. Eight S's in the left temporal damaged group and eight S's in the left damaged control group were randomly assigned to Sequence 1 while the other seven S's in both groups were randomly assigned to Sequence 2.

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[2] One memory-impaired S and his memory-intact control had an hour delay before the thirteenth recall trial.

It was necessary to control for the order of presentation of the two forms since an S's performance on the form presented second may have been affected by fatigue effects, practice effects, or interference effects from the form presented first.

Both forms were given during the same testing session because this type of administration allows for the best analysis of reliability across forms since any variability in performance across forms is not confounded by temporal or organismic variables (Anastasi, 1968) such as the change in higher brain functioning in a chronic alcoholic as he maintains sobriety.

The 30 minute delay period with the interpolated task was incorporated in the testing sequence to prevent the S from rehearsing the words that he had recalled on trial 12 before trial 13 was administered.

Procedure

Test administration was done almost entirely by the author with only minimal assistance from other qualified examiners. The following procedure was employed for administering both the animal and the food forms. (See Appendix C for the instructions to the S's prior to the administration of the animal and the food forms.) The 20 list words were read to each S at a 2 second rate per word. After each word was presented, the S repeated it to indicate adequate stimulus reception. Immediately following presentation, each S recalled all the words that he could and was urged to extend his recall until he failed to recall any additional words (new or repeated) for a period of 20 seconds. At the beginning of trial 2 and all subsequent trials where necessary, he was re-presented those words he had not yet recalled at all and was then asked to recall all of the words from the entire list. A particular word was presented again only if it had not yet been recalled by the S on any trial. After the point in the test when all re-presentations had been discontinued, each recall trial began with the examiner asking the S to recall as many words as possible from the list and ended when the S failed to respond for a period of 20 seconds. Throughout the test no feedback for the correctness of a response was provided since responses (correct or incorrect) were merely recorded on the scoring sheet.

Immediately following trial 12, the examiner recorded the time in order that 30 minutes later (without any prior warning to the S) a thirteenth recall trial could be administered. During this 30 minute period, each S was given either the verbal portion of the short-form WAIS or a neuropsychological test not involving memory functioning if the WAIS had been given earlier. Following the delay and the completion of the thirteenth recall trial, the S's were given either the animal or food form of the test, depending upon which form they were given initially.

Scoring

The scoring of both forms was done as follows. Thirteen scores were tabulated from each S's test, thereby yielding two sets of scores for each S. All 13 scores were based upon the S's performance over the first 12 trials; performance on trial 13 was not included in the tabulation of these scores. These 13 scores were 1) total retrievals from LTM; 2) total intrusions; 3) total re-presentations; 4) total words in LTM (WLTM); 5) retrievals on trial 12; 6-9) total words retrieved consistently on all 12 trials (CR12), on the last 9 consecutive trials (CR9), on the last 6 consecutive trials (CR6), and on the last 3 consecutive trials (CR3); and 10-13) the percentage of words in LTM retrieved consistently on all 12 trials (CR12/WLTM), on the last 9 consecutive trials (CR9/WLTM), on the last 6 consecutive trials (CR6/WLTM), and on the last 3 consecutive trials (CR3/WLTM).

Total number of retrievals from LTM was tabulated by summing the total number of correct recalls for any word that was recalled at least twice. A single recall of a word over all 12 trials was not counted as a retrieval. The range for this score was 0 to 240.

The total number of intrusions was tabulated by summing the total number of words given on all 12 trials that were not on the list. There was no range established for this score since there was no upper limit on the number of incorrect responses.

The total number of re-presentations was tabulated by summing the number of presentations of any of the list words after initial presentation of the words. The range for this score was 0 to 220.

Words in LTM (WLTM) was tabulated by summing the number of words which were recalled at least twice over the 12 recall trials. The range for this score was 0 to 20.

The number of retrievals on trial 12 was tabulated by summing the number of correct recalls on this trial. The range for this score was 0 to 20.

Total number of words consistently retrieved was tabulated by summing the number of words which were retrieved consistently on all 12 trials (CR12), at least the last 9 consecutive trials (CR9), at least the last 6 consecutive trials (CR6), and at least the last 3 consecutive trials (CR3). The range for each score was 0 to 20.

The percentage of WLTM that were consistently retrieved was tabulated by dividing each of the 4 consistent retrieval scores by WLTM. The range for each score was 0 to 100%.

A tabulation was also made of the number of retrievals on trial 13 by summing the number of correct recalls on this trial. The range for this score was 0 to 20.

The scoring of the verbal portion of the short-form WAIS was done in accordance with the scoring procedure outlined by Satz and Mogel (1962) and presented in Appendix B while the scoring of the Wechsler Intelligence Scale for Children (WISC) was done in accordance with the standard WISC scoring procedure.

Statistical Analyses

The statistical analyses utilized in this study depended upon the question addressed.

Paired t-tests were utilized to analyze difference scores between the number of words recalled on trial 12 and the number of words recalled on trial 13 to determine if there was a significant difference between the number of recalls on trials 12 and 13 for either the memory-impaired or the memory-intact S's. Comparisons using two sample t-tests were then made to determine if the difference scores were significantly different between the memory-impaired and memory-intact groups.

Pearson product moment correlations were utilized to analyze the alternate-form reliability of the two forms of the test. Since no assumption could be made as to what effect the order of presentation of the forms or the diagnostic classification of the individual (memory-impaired or memory-intact) would have on the correlation of the scores from the two forms, these factors and their possible interaction were controlled for statistically in the correlational analyses.

Analyses of the equivalency of the two forms, of the concurrent validity of the tests, and of the LTVM deficits of the two memory-impaired groups were effected by utilizing a multivariate extension of the _t_-test (Hotelling's T^2 statistic) across the means of the various scores of the groups. This multivariate statistical analysis was used rather than using multiple univariate analyses because the use of the latter increases the probability of a Type I error while the use of the former helps control for Type I errors without being too conservative (Hummell and Sligo, 1971). If the multivariate analysis across the means of all the scores was found to be significant, then separate univariate analyses (two sample _t_-tests or paired _t_-tests) were performed on the means of the individual scores of the groups to determine if any of the means were significantly different. Because the multivariate analysis helps control for Type I errors, any significant differences obtained with the univariate analyses were attributed with greater confidence to real differences existing between the groups.

In order to determine the accuracy of the scores from each form of the test in discriminating between the memory-impaired and the memory-intact _S_'s, a discriminant analysis was performed which analyzed the number of correct classifications and the number of misclassifications (false negatives and false positives) made by the scores taken as a whole from each form.

CHAPTER III
RESULTS

Analysis of the Effects of a 30 Minute Delay on Retrieval from LTM

Difference (D) scores were derived for all *S*'s by subtracting the individual's number of recalls on trial 12 from his number of recalls on trial 13 on that form of the test on which he received a thirteenth recall trial. Mean difference scores ($\bar{D}$) are presented in Table 2 for 15 memory-impaired *S*'s who were given the animal form, 15 memory-intact *S*'s who were given the animal form, 15 memory-impaired *S*'s who were given the food form, and 15 memory-intact *S*'s who were given the food form. Paired *t*-tests of the $\bar{D}$ scores for the four groups revealed that none of the $\bar{D}$ values were significantly different from zero. A comparison (two sample *t*-tests) of the $\bar{D}$ scores for the 15 memory-impaired and 15 memory-intact *S*'s who received the animal form revealed no differences between the two groups ($t = .25$; $df = 28$; $p \leq .81$). The same comparison for the 15 memory-impaired and 15 memory-intact *S*'s who received the food form revealed no differences between the two groups ($t = .70$; $df = 28$; $p \leq .49$).

Analysis of the Alternate-Form Reliability and Equivalency of the Two Forms

Pearson product moment correlations for the 13 scores from the two forms were obtained after controlling statistically for the possible effects of the order of presentation of the forms, diagnostic status of the *S*'s, and the interaction between the order and the diagnostic status. The correlational coefficients for the scores from the two forms are

Table 2

Mean Difference Scores ($\overline{D}$), Standard Deviations, Ranges, and Tests of Significance for Two Memory-Impaired (MIMP) Groups and Two Memory-Intact (MINT) Groups on the Animal and Food Forms

Group	Form	n	$\overline{D}$	SD	Range	t-value	p-value
MIMP	Animal	15	.47	1.41	-3 to 2	1.28	.22
MINT	Animal	15	.60	1.40	-1 to 4	1.66	.12
MIMP	Food	15	.07	.80	-1 to 2	.32	.75
MINT	Food	15	.33	1.18	-2 to 2	1.10	.29

presented in Table 3 for 1) all S's, 2) the total memory-impaired group, and 3) the total memory-intact group.

All 13 coefficients for the 60 S's were statistically significant, but only the coefficient for total retrievals (.81) was above the ideal coefficient of .80. Eleven of the coefficients for the total memory-impaired group were statistically significant with only CR12 and CR12/WLTM being nonsignificant. The coefficient for total retrievals (.84) was the only coefficient above the ideal coefficient of .80. Eleven of the coefficients for the total memory-intact group were statistically significant with only total re-presentations and WLTM being nonsignificant. None of the coefficients were above the ideal coefficient of .80.

The equivalency of the two forms was analyzed multivariately (Hotelling T^2 statistic) by comparing the means of the scores of the two forms for 1) all S's, 2) the total memory-impaired group, and 3) the total memory-intact group. An overall significant difference was found between the means of the scores for the two forms for all S's ($F = 3.00$; $df = 13,47$; $p \leq .0029$). Univariate analyses (paired t-tests) of the means are presented in Table 4 and revealed that the means of only one score (total re-presentations) were significantly different. No overall difference between the means of the 13 scores for the two forms was found for either the total memory-impaired group ($F = 0.97$; $df = 13,17$; $p \leq .516$) or the total memory-intact group ($F = 1.85$; $df = 13,17$; $p \leq .116$).

Analysis of the Concurrent Validity of Both Forms

A multivariate analysis (Hotelling T^2 statistic) of the means of the 13 scores from the animal form of Buschke's test for the total memory-impaired group and the total memory-intact group revealed a significant

Table 3
Pearson Correlation Coefficients Between Scores from the Animal Form and the Food Form for All Subjects, the Total Memory-Impaired (MIMP) Group, and the Total Memory-Intact (MINT) Group

Score	All S's	MIMP	MINT
Total Retrievals	.81 [a]	.84 [a]	.75 [a]
Total Intrusions	.62 [a]	.68 [a]	.56 [b]
Total Re-presentations	.67 [a]	.74 [a]	.32
WLTM	.50 [a]	.58 [a]	.27
Retrievals on Trial 12	.66 [a]	.78 [a]	.40 [c]
CR12	.46 [a]	.29	.57 [b]
CR9	.60 [a]	.57 [b]	.61 [a]
CR6	.69 [a]	.64 [a]	.73 [a]
CR3	.71 [a]	.78 [a]	.62 [a]
CR12/WLTM	.31 [c]	.10	.51 [b]
CR9/WLTM	.46 [a]	.46 [c]	.47 [c]
CR6/WLTM	.55 [a]	.56 [b]	.55 [b]
CR3/WLTM	.61 [a]	.72 [a]	.51 [b]

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[a] $p < .001$

[b] $p < .01$

[c] $p < .05$

Table 4
Means, Standard Deviations, and Tests of Significance for Scores from the Animal Form and the Food Form for All Subjects

Score	Form	Mean	SD	t-value	p-value
Total Retrievals	Animal	140.72	41.53	1.34	.186
	Food	137.70	36.43		
Total Intrusions	Animal	14.78	15.18	0.35	.73
	Food	14.17	16.82		
Total Re-presentations	Animal	14.60	8.27	3.05	.003
	Food	16.78	7.77		
WLTM	Animal	15.47	2.99	0.60	.551
	Food	15.28	2.71		
Retrievals on Trial 12	Animal	12.47	4.12	0.22	.831
	Food	12.53	3.63		
CR12	Animal	3.50	2.95	0.74	.462
	Food	3.27	2.21		
CR9	Animal	6.52	3.82	1.06	.293
	Food	6.88	3.49		
CR6	Animal	8.73	4.15	0.67	.503
	Food	8.97	3.63		
CR3	Animal	10.83	4.20	0.69	.49
	Food	11.05	3.61		
CR12/WLTM	Animal	21.13	16.27	0.00	.981
	Food	21.08	13.80		
CR9/WLTM	Animal	40.90	19.99	1.36	.178
	Food	44.02	19.49		
CR6/WLTM	Animal	55.13	21.13	0.98	.33
	Food	57.43	19.24		
CR3/WLTM	Animal	68.33	18.64	1.58	.119
	Food	71.30	17.59		

overall difference between the groups ($F = 5.00$; $df = 13,46$; $p \leq .0001$). This same analysis was done for the means for the 13 scores from the food form for both these groups and revealed a significant overall difference between the groups ($F = 4.64$; $df = 13,46$; $p \leq .0001$).

Univariate analyses (two sample t-tests) of the means from the animal form are presented in Table 5, and univariate analyses of the means from the food form are presented in Table 6. These analyses revealed that for each form there were significant differences between the groups on 12 of the 13 scores with total intrusions being the only score from each form which did not differentiate between the groups.

As can be seen from the ranges presented in Table 5 and Table 6, there was overlap in the scores obtained by memory-impaired and memory-intact _S_'s on each form. Consequently, a discriminant analysis of the scores from each form was effected to determine how well they classified the _S_'s according to their diagnostic classification of either memory-impaired or memory-intact. This analysis revealed that the scores from the animal form taken as a whole and the scores from the food form taken as a whole were each able to classify correctly 56 of the 60 _S_'s (correct classification = 93.3%) with 3 false negatives and 1 false positive. Cut-off scores which best classified the 60 _S_'s were then derived by visual inspection for all scores except total intrusions for the animal form and the food form. (Total intrusions was excluded because the univariate analyses had found that it was the only score from both forms that failed to discriminate between the groups.) For all scores except total re-presentations, an _S_ was classified as memory-impaired if his score fell below the cut-off score; on total re-presentations, he was classified as memory-impaired if his score was above the cut-off score.

Table 5
Means, Standard Deviations, Ranges, and Tests of Significance for Scores from the Animal Form for the Total Memory-Impaired (MIMP) Group and the Total Memory-Intact (MINT) Group

Score		Mean	SD	Range	t-value	p-value
Total Retrievals	MIMP	111.93	35.38	49-183	7.44	.0001
	MINT	169.50	23.31	137-214		
Total Intrusions	MIMP	16.80	15.86	0-51	1.03	.154
	MINT	12.77	14.45	0-49		
Total Re-presentations	MIMP	18.37	9.61	5-49	3.94	.0001
	MINT	10.83	4.16	4-23		
WLTM	MIMP	13.53	2.79	6-19	6.56	.0001
	MINT	17.40	1.63	13-20		
Retrievals on Trial 12	MIMP	9.80	3.65	3-17	6.55	.0001
	MINT	15.13	2.56	10-20		
CR12	MIMP	2.13	2.22	0- 9	4.02	.0001
	MINT	4.87	2.99	0-12		
CR9	MIMP	4.53	2.58	0-12	4.67	.0001
	MINT	8.50	3.87	3-17		
CR6	MIMP	6.70	3.81	0-16	4.33	.0001
	MINT	10.77	3.46	4-18		
CR3	MIMP	8.43	3.72	2-16	5.38	.0001
	MINT	13.23	3.17	8-19		
CR12/WLTM	MIMP	14.40	13.37	0-50	3.50	.0004
	MINT	27.87	16.31	0-66		
CR9/WLTM	MIMP	32.90	15.31	0-67	3.36	.0007
	MINT	48.90	21.13	15-85		
CR6/WLTM	MIMP	48.33	21.98	0-89	2.61	.006
	MINT	61.93	18.15	21-90		
CR3/WLTM	MIMP	60.87	18.87	17-89	3.36	.0007
	MINT	75.80	15.34	50-100		

Table 6
Means, Standard Deviations, Ranges, and Tests of Significance for Scores from the Food Form for the Total Memory-Impaired (MIMP) Group and the Total Memory-Intact (MINT) Group

Score		Mean	SD	Range	t-value	p-value
Total Retrievals	MIMP	112.77	32.44	34-176	7.26	.0001
	MINT	162.63	19.03	132-212		
Total Intrusions	MIMP	15.20	17.00	0-70	0.47	.319
	MINT	13.13	16.87	0-68		
Total Re-presentations	MIMP	20.03	9.22	8-47	3.54	.0004
	MINT	13.53	4.01	7-24		
WLTM	MIMP	13.90	2.86	6-18	4.57	.0001
	MINT	16.67	1.69	14-20		
Retrievals on Trial 12	MIMP	10.20	3.37	1-16	6.49	.0001
	MINT	14.87	2.05	10-18		
CR12	MIMP	2.13	1.76	0- 6	4.61	.0001
	MINT	4.40	2.04	1-10		
CR9	MIMP	4.57	2.11	0- 8	6.87	.0001
	MINT	9.20	3.03	4-16		
CR6	MIMP	6.50	2.66	1-12	7.18	.0001
	MINT	11.43	2.66	8-18		
CR3	MIMP	8.67	3.15	1-16	6.80	.0001
	MINT	13.43	2.19	10-18		
CR12/WLTM	MIMP	15.50	13.58	0-55	3.40	.0006
	MINT	26.67	11.77	7-56		
CR9/WLTM	MIMP	32.70	15.01	0-55	5.50	.0001
	MINT	55.33	16.82	24-89		
CR6/WLTM	MIMP	46.20	16.76	11-80	5.55	.0001
	MINT	68.67	14.53	47-100		
CR3/WLTM	MIMP	62.03	18.76	11-91	4.78	.0001
	MINT	80.57	9.98	59-100		

These cut-off scores, the number of correct classifications, false negatives, false positives, and the percentage of correct classifications are presented in Table 7. As can be seen, the ability of an individual score to correctly classify the S's ranged from 68% to 90% correct classification for the animal form and from 70% to 88% correct classification for the food form with total retrievals being the best classification score for each form.

Analysis of the LTVM Deficits within Two Memory-Impaired Groups

Analysis of the LTVM Deficits of the Alcohol Abuse Group on Both Forms

A multivariate analysis (Hotelling T^2 statistic) of the means of the 13 scores from the animal form for the chronic alcohol abuse group and the alcohol abuse control group revealed a significant overall difference between the groups ($F = 3.25$; $df = 13,16$; $p \leq .007$). This same analysis was done for the means for the 13 scores from the food form for both these groups and revealed a significant overall difference between the groups ($F = 2.13$; $df = 13,16$; $p \leq .038$).

Univariate analyses (two sample t-tests) of the means from the animal form are presented in Table 8, and univariate analyses of the means from the food form are presented in Table 9. These analyses revealed that for each form there were significant differences between the groups since all scores from the animal form except total intrusions and CR6/WLTM differentiated between groups and all scores from the food form except total intrusions differentiated between groups.

Analysis of the LTVM Deficits of the Left Temporal Damaged Group on Both Forms

A multivariate analysis (Hotelling T^2 statistic) of the means of the 13 scores from the animal form for the left temporal damaged group and the left damaged control group revealed a significant overall difference

Table 7
Cut-off Scores, Correct Classifications, False Negatives, False Positives, and Percentage of Correct Classifications for Scores from the Animal Form and from the Food Form

Score	Form	Cut-off Score	Correct Class.	False Neg.	False Pos.	% Correct Class.
Total Retrievals	A	132	54	6	0	90
	F	138	53	5	2	88
Total Re-presentations	A	14	45	11	4	75
	F	17	44	13	3	73
WLTM	A	15	50	7	3	83
	F	15	44	9	7	73
Retrievals on Trial 12	A	11	50	8	2	83
	F	13	50	3	7	83
CR12	A	4	44	3	13	73
	F	3	44	7	9	73
CR9	A	6	44	4	12	73
	F	8	47	0	13	78
CR6	A	8	44	6	10	73
	F	7	51	9	0	85
CR3	A	10	46	7	7	77
	F	10	51	7	2	85
CR12/WLTM	A	27	43	4	13	72
	F	20	42	9	9	70
CR9/WLTM	A	50	41	3	16	68
	F	55	48	0	12	80
CR6/WLTM	A	58	41	8	11	68
	F	62	44	7	9	73
CR3/WLTM	A	75	42	6	12	70
	F	68	48	10	2	80

Table 8
Means, Standard Deviations, Ranges, and Tests of Significance for Scores from the Animal Form for the Chronic Alcohol Abuse (CAA) Group and the Alcohol Abuse Control (AAC) Group

Score		Mean	SD	Range	t-value	p-value
Total Retrievals	CAA	121.53	28.52	91-183	5.15	.0001
	AAC	170.93	23.80	137-214		
Total Intrusions	CAA	12.40	13.38	0-43	0.80	.214
	AAC	8.87	10.48	0-37		
Total Re-presentations	CAA	17.13	6.71	5-26	3.07	.002
	AAC	10.80	4.36	5-23		
WLTM	CAA	14.33	2.23	11-19	3.96	.0002
	AAC	17.33	1.91	13-20		
Retrievals on Trial 12	CAA	10.67	3.04	7-17	4.38	.0001
	AAC	15.33	2.79	10-20		
CR12	CAA	3.00	2.70	0- 9	2.48	.01
	AAC	5.67	3.18	1-12		
CR9	CAA	5.47	2.80	1-12	3.02	.003
	AAC	9.33	4.08	3-17		
CR6	CAA	7.60	3.56	2-16	2.44	.01
	AAC	10.93	3.90	4-18		
CR3	CAA	9.27	3.01	6-16	3.83	.0004
	AAC	13.53	3.09	8-19		
CR12/WLTM	CAA	19.60	15.80	0-50	2.17	.02
	AAC	32.73	17.40	5-66		
CR9/WLTM	CAA	37.73	15.91	7-67	2.32	.01
	AAC	54.40	22.76	15-85		
CR6/WLTM	CAA	52.27	19.95	14-89	1.49	.073
	AAC	63.47	21.12	21-90		
CR3/WLTM	CAA	64.00	14.35	43-89	2.62	.007
	AAC	77.93	14.72	50-95		

Table 9
Means, Standard Deviations, Ranges, and Tests of Significance for Scores from the Food Form for the Chronic Alcohol Abuse (CAA) Group and the Alcohol Abuse Control (AAC) Group

Score		Mean	SD	Range	t-value	p-value
Total Retrievals	CAA	124.13	23.38	89-176	4.85	.0001
	AAC	163.87	21.47	136-212		
Total Intrusions	CAA	10.33	10.80	0-40	0.20	.426
	AAC	11.20	14.04	0-49		
Total Re-presentations	CAA	18.07	6.78	8-31	2.65	.007
	AAC	12.60	4.24	7-24		
WLTM	CAA	14.80	2.01	12-18	2.25	.02
	AAC	16.40	1.88	14-20		
Retrievals on Trial 12	CAA	11.33	2.61	8-16	4.25	.0001
	AAC	14.87	1.88	12-18		
CR12	CAA	2.53	1.73	0- 5	3.62	.0006
	AAC	5.20	2.27	2-10		
CR9	CAA	5.47	1.68	3- 8	4.79	.0001
	AAC	10.00	3.25	5-16		
CR6	CAA	7.20	2.51	5-12	4.77	.0001
	AAC	12.00	2.98	9-18		
CR3	CAA	9.60	2.82	6-16	4.39	.0001
	AAC	13.73	2.31	11-18		
CR12/WLTM	CAA	17.67	12.13	0-33	3.22	.002
	AAC	32.00	12.25	11-56		
CR9/WLTM	CAA	37.53	11.62	18-54	4.37	.0001
	AAC	60.80	17.01	31-89		
CR6/WLTM	CAA	47.93	15.64	24-80	4.49	.0001
	AAC	72.87	14.74	53-100		
CR3/WLTM	CAA	65.20	16.75	43-89	3.71	.0005
	AAC	83.73	9.67	69-100		

between the groups ($\underline{F} = 3.03$; $\underline{df} = 13,16$; $\underline{p} \leq .008$). This same analysis was done for the means for the 13 scores from the food form for these groups and revealed a significant overall difference between the groups ($\underline{F} = 3.12$; $\underline{df} = 13,16$; $\underline{p} \leq .009$).

Univariate analyses (two sample *t*-tests) of the means from the animal form are presented in Table 10, and univariate analyses of the means from the food form are presented in Table 11. These analyses revealed that for each form there were significant differences between the groups on 12 of the 13 scores with total intrusions being the only score from each form which did not differentiate between the groups.

Comparison of the LTVM Deficits of the Chronic Alcohol Abuse Group and the Left Temporal Damaged Group on Both Forms

A multivariate analysis (Hotelling T^2 statistic) of the means of the 13 scores from the animal form for the chronic alcohol abuse group and the left temporal damaged group revealed no overall difference between the groups ($\underline{F} = 0.93$; $\underline{df} = 13,16$; $\underline{p} \leq .546$). This same analysis was done for the means for the 13 scores from the food form for these groups and revealed no overall difference between the groups ($\underline{F} = 0.94$; $\underline{df} = 13,16$; $\underline{p} \leq .541$).

Analysis of the LTVM Deficits of a Chronic Alcohol Abuse *S* and a Left Temporal Damaged *S*

An illustrative case was chosen from each of the two memory-impaired groups in order to demonstrate the applicability of Buschke's test in describing the LTVM deficits of an individual *S*. The *S*'s were selected not because they are representative of their groups but because their scores provided a good description of their LTVM functioning.

Table 12 presents the scores from the food form for a chronic alcohol abuse *S* and a left temporal damaged *S* as well as the cut-off scores from

Table 10

Means, Standard Deviations, Ranges, and Tests of Significance for Scores from the Animal Form for the Left Temporal Damaged (LTD) Group and the Left Damaged Control (LDC) Group

Score		Mean	SD	Range	t-value	p-value
Total Retrievals	LTD	102.33	39.77	49-176	5.51	.0001
	LDC	168.07	23.55	141-213		
Total Intrusions	LTD	21.20	17.33	0-51	0.72	.238
	LDC	16.67	17.04	0-49		
Total Re-presentations	LTD	19.60	11.97	8-49	2.67	.006
	LDC	10.87	4.10	4-18		
WLTM	LTD	12.73	3.13	6-18	5.38	.0001
	LDC	17.47	1.36	15-20		
Retrievals on Trial 12	LTD	8.93	4.10	3-16	4.91	.0001
	LDC	14.93	2.37	12-19		
CR12	LTD	1.27	1.16	0- 4	3.74	.0005
	LDC	4.07	2.66	0- 9		
CR9	LTD	3.60	2.03	0- 8	3.83	.0004
	LDC	7.67	3.58	4-14		
CR6	LTD	5.80	3.95	0-14	3.71	.0005
	LDC	10.60	3.09	6-15		
CR3	LTD	7.60	4.26	2-16	3.82	.0004
	LDC	12.93	3.33	9-19		
CR12/WLTM	LTD	9.20	7.92	0-25	3.31	.001
	LDC	23.00	14.07	0-45		
CR9/WLTM	LTD	28.07	13.49	0-50	2.59	.007
	LDC	43.40	18.48	21-78		
CR6/WLTM	LTD	44.40	23.86	0-80	2.19	.02
	LDC	60.40	15.22	38-79		
CR3/WLTM	LTD	57.73	22.60	17-89	2.22	.01
	LDC	73.67	16.15	50-100		

Table 11
Means, Standard Deviations, Ranges, and Tests of Significance for Scores from the Food Form for the Left Temporal Damaged (LTD) Group and the Left Damaged Control (LDC) Group

Score		Mean	SD	Range	t-value	p-value
Total Retrievals	LTD	101.40	36.83	34-160	5.73	.0001
	LDC	161.40	16.91	132-197		
Total Intrusions	LTD	20.07	20.76	0-70	0.68	.252
	LDC	15.07	19.60	0-68		
Total Re-presentations	LTD	22.00	11.04	8-47	2.51	.009
	LDC	14.47	3.66	9-22		
WLTM	LTD	13.00	3.34	6-18	4.17	.0002
	LDC	16.93	1.49	14-19		
Retrievals on Trial 12	LTD	9.07	3.73	1-13	5.15	.0001
	LDC	14.87	2.26	10-18		
CR12	LTD	1.73	1.75	0- 6	3.18	.002
	LDC	3.60	1.45	1- 6		
CR9	LTD	3.67	2.16	0- 7	5.34	.0001
	LDC	8.40	2.67	4-14		
CR6	LTD	5.80	2.70	1-10	5.56	.0001
	LDC	10.87	2.26	8-16		
CR3	LTD	7.73	3.28	1-12	5.37	.0001
	LDC	13.13	2.10	10-17		
CR12/WLTM	LTD	13.33	14.99	0-55	1.79	.04
	LDC	21.33	8.71	7-40		
CR9/WLTM	LTD	27.87	16.78	0-55	3.76	.0004
	LDC	49.87	15.25	24-78		
CR6/WLTM	LTD	44.47	18.20	11-71	3.42	.001
	LDC	64.47	13.50	47-89		
CR3/WLTM	LTD	58.87	20.66	11-91	3.15	.002
	LDC	77.40	9.55	59-93		

Table 12
Scores from the Food Form for a Chronic Alcohol Abuse (CAA) _S_ and a Left Temporal Damaged (LTD) _S_ and Food Form Cut-Off Scores

	CAA S's Score	Cut-Off Score	LTD S's Score
Total Retrievals	111	138	34
Total Intrusions	10	not specified	48
Total Re-presentations	23	17	26
WLTM	17	15	9
Retrievals on Trial 12	12	13	1
CR12	1	3	0
CR9	3	8	0
CR6	6	7	1
CR3	9	10	1
CR12/WLTM	6%	20%	0%
CR9/WLTM	18%	55%	0%
CR6/WLTM	24%	62%	11%
CR3/WLTM	53%	68%	11%

Note: An identical pattern of scores was obtained from the animal form of the test for both _S_'s.

the food form which best discriminated between the memory-impaired and memory-intact S's. As can be seen, all scores with the exception of WLTM fell within the memory-impaired range for the chronic alcohol abuse S while all scores fell within the memory-impaired range for the left temporal damaged S. Moreover, the scores for the left temporal damaged S were considerably lower than both the cut-off scores and the scores of the chronic alcohol abuse S.

CHAPTER IV
DISCUSSION

The present study was addressed to four questions regarding the clinical utility of Buschke's restricted reminding procedure as a test of LTVM functioning. Consequently, the results related to each of these questions are discussed separately.

Effects of a 30 Minute Delay on Retrieval from LTM

No significant difference was found between the number of words recalled on trial 12 and the number recalled on trial 13 for either the memory-impaired or the memory-intact groups. Since the 30 minute delay with the distractor task prevented the words recalled on trial 12 from being rehearsed and maintained in STM, the words recalled on trial 13 were being retrieved from LTM. Because the number of recalls on trial 12 and trial 13 were essentially the same, it is assumed that trial 12 and trial 13 are tapping the same LTM retrieval process and that at least on trial 12 of Buschke's test LTVM functioning is being assessed. Since the stimulus parameters for trial 12 are identical to those for any other trial in which there are no re-presentations (typically trials 5 through 11), this finding provides indirect support for the assertion that on the majority of the recall trials Buschke's test is assessing LTVM functioning. This assertion has direct empirical support since Buschke (1974) found no difference between the performance on his test as it is typically given and the performance on his test when a short distractor task which prevented the maintenance of words in STM was inserted prior to recalling the list words on every trial. Thus, the finding of this study coupled with Buschke's finding (1974) lends empirical support to the conceptualization of Buschke's restricted reminding procedure as a test of LTVM functioning.

Alternate-Form Reliability and Equivalency of the Two Forms

The alternate-form reliability of Buschke's test was found to be adequate when analyzed for the entire 60 S's since all 13 reliability coefficients for the 13 scores from the two forms were statistically significant with 8 of the coefficients being equal to or above .60. However, it was found to be less adequate when analyzed for the 30 memory-impaired S's and for the 30 memory-intact S's since 4 of the 26 reliability coefficients were not statistically significant. The alternate-form reliability was found to be very questionable when compared to the ideal standard of .80 or greater since only one of the 13 coefficients for the entire 60 S's, only one of the 13 for the 30 memory-impaired S's, and none of the 13 for the 30 memory-intact S's were above .80. However, comparing the reliability coefficients for all scores on the test against the ideal coefficient may be an inappropriate comparison considering the relatively small sample utilized in the study and the relatively large number of scores generated by the test. Perhaps a more appropriate comparison would be to compare the reliability coefficient of total retrievals to the ideal coefficient since total retrievals is the most representative score on the test due to its being affected by six other scores on the test (WLTM, retrievals on trial 12, CR12, CR9, CR6, CR3). (This interdependence is verified by correlations ranging from .61 to .94 between total retrievals and these scores for the 60 S's.) When this comparison is made, Buschke's test appears to be quite reliable since the reliability coefficients for total retrievals on both forms was .81 for all 60 S's, .84 for the 30 memory-impaired S's, and .75 for the 30 memory-intact S's.

The equivalency of the two forms of the test was found to be quite good since there was no overall difference between the scores on the two forms for either the total memory-impaired group or the total memory-intact group and since there was no difference between 12 of the 13 scores for all 60 S's. The only score which was not equivalent for the two forms for all 60 S's was total re-presentations since there were significantly more re-presentations given on the food form. Perhaps this difference can be accounted for by the fact that the category foods is broader than the category animals (especially since Buschke's animals are restricted to four-footed animals) and that its words are more difficult to store or retrieve initially due to problems in semantic organization. Further research with this procedure comparing these forms with other forms based upon different categories of varying breadth will help clarify the reason for this difference in the re-presentation score.

Concurrent Validity of Both Forms

The concurrent validity of both forms was found to be quite satisfactory since 12 of the 13 scores from each form were able to differentiate between the total memory-impaired group and the total memory-intact group. On these scores, the memory-impaired group was found to have significantly fewer total retrievals from LTM, more total re-presentations of list words, fewer words in LTM, fewer retrievals on trial 12, fewer consistent retrievals regardless of the number of consecutive trials specified. Thus, on both forms of Buschke's test, the memory-impaired *S*'s demonstrated that they indeed were impaired with regards to LTVM functioning.

The only score of the 13 scores which failed to differentiate between the total memory-impaired group and the total memory-intact group was total intrusions. Why this score failed to discriminate between the two groups is unclear although the following discussion offers one possible explanation. It may be that the number of intrusions by a memory-impaired *S* is affected by two major factors which tend to cancel one another. The first factor may be labeled retrieval interference and may be conceptualized as increasing the number of intrusions by a memory-impaired *S* since he is unable to discriminate between a correct and an incorrect retrieval. There is some empirical support for this conceptualization since research with memory-impaired *S*'s has found that there are a significant number of intrusions with some *S*'s apparently due to retrieval interference (Weiskrantz and Warrington, 1975). The second factor may be labeled cautiousness or the willingness to guess and may be conceptualized as decreasing the number of intrusions by a memory-impaired *S* since he is less confident of his retrieval ability due to memory failures in the past. There is also some empirical support for this conceptualization since it has been reported that memory-impaired *S*'s are much more cautious and less willing to guess than are normal *S*'s (Brooks, 1974a). Consequently, the number of intrusions for the memory-impaired *S*'s may not be significantly different from the number of intrusions for the memory-intact *S*'s due to the interaction of these two factors.

The ability of the test to classify correctly the entire group of 60 S's according to their diagnostic status was found to be excellent since both forms correctly classified 93.3% of all the S's. This high percentage of correct classification is especially good since in some cases the memory-impairment may have been mild and since there may have been an initial misclassification of a small number of memory-impaired S's due to their having no verbal memory deficits despite complaining of verbal memory problems and having a high probability of such a problem because of organic or potential organic dysfunction. The score which accounted for the major portion of the test's ability to classify correctly the 60 S's was total retrievals since a cut-off score on the animal form of the test correctly classified 90% of the S's while a similar score on the food form correctly classified 88% of the S's. The ability of this score to discriminate almost as well as the 13 scores taken as a whole is due to the fact that total retrievals is largely a composite of six of the other scores (WLTM, retrievals on trial 12, CR12, CR9, CR6, CR3).

Thus, the ability of Buschke's test to discriminate between the two groups was found to be quite good; however, results from further research which can cross-validate the findings of this study are needed before the test's discriminative power can be established beyond this small sample.

LTVM Deficits within Two Memory-Impaired Groups

LTVM Deficits of the Chronic Alcohol Abuse Group

The chronic alcohol abuse group was found to be significantly different from the alcohol abuse control group on 11 of the 13 scores on the animal form and 12 of the 13 scores from the food form. The only score from both forms which failed to differentiate between the two groups was total intrusions.

On both forms, the chronic alcohol abuse group was found to have fewer total retrievals from LTM, fewer consistent retrievals from LTM regardless of the number of consecutive trials specified, and fewer retrievals on trial 12. Because all of these scores are affected by the number of words from the list that are stored in LTM since a word cannot be considered to have been retrieved from LTM before its storage in LTM has been demonstrated, deficits in either storage or retrieval or both may have accounted for the poorer performance by the chronic alcohol abuse group. Similarly, the need for more re-presentations of the list words by the chronic alcohol abuse group may have been produced in part by either a long-term storage or retrieval problem or both since the re-presented words may not have been stored or may have been stored but not retrieved.

Data from the other scores on both forms revealed that the chronic alcohol abuse group appeared to have deficits in both the long-term storage and retrieval of verbal information. The deficit in the storage of verbal information in LTM was evidenced by the significantly fewer words which were stored in LTM. The deficit in the retrieval of verbal information from LTM was evidenced by the significantly lower percentages of words demonstrated to be stored in LTM which were retrieved consistently since using the number of words stored in LTM by each S as the maximum number of words that could be retrieved consistently controlled for the effect of storage on this score. Thus, Buschke's test provided detailed information on the LTVM deficits of the chronic alcohol abuse group since it demonstrated not only that the group had significant verbal memory deficits involving LTM but also that these deficits involved both the long-term storage and retrieval of verbal information.

The significant verbal memory deficits of the chronic alcohol abuse group which were found in this study are consistent with findings from other research which have documented the general verbal memory deficits of chronic alcoholics who have abstained from alcohol for one week or less (Ellenberg, 1975; Johsson et al., 1962; Sharp et al., 1977; Weingartner et al., 1971). However, the finding that the alcoholics in this study had LTVM deficits in general and deficits in both the long-term storage and retrieval of verbal information in particular has not been documented in any depth with nonKorsakoff alcoholics since only one study with one patient (Buschke and Fuld, 1974) has reported similar findings with this subgroup of alcoholic patients.

Considerable research has been done on the LTVM deficits of chronic alcoholics who have been judged to have Korsakoff's syndrome although there is a great deal of controversy concerning the nature of these deficits. Results from the collaborative research of Butters and Cermak and their associates (summarized to a great extent in Butters and Cermak, 1975) has led these researchers to conclude 1) that the verbal memory deficit of the Korsakoff patient is either in the storage of verbal information in STM or in the transfer of verbal information from STM to LTM with the end result being that only a limited amount of verbal material is encoded and stored in LTM and 2) that the Korsakoff patient has no problem in retrieving verbal information from LTM once that information has been encoded and stored in LTM. Conclusions which are diametrically opposed to those above have been drawn from the results of the collaborative research done by Warrington and Weiskrantz and their associates (summarized to a great extent in Weiskrantz and Warrington, 1975) since these researchers have concluded 1) that the Korsakoff patient has a problem in the retrieval of verbal information from LTM because his ability to retrieve information is adversely affected by the interference of competing material and 2) that the Korsakoff patient has no real deficit in the encoding and storage of information in LTM. Although the conclusions drawn by these research groups are diametrically opposed, it is possible that deficits in both the storage and retrieval of verbal information are associated with Korsakoff's syndrome and that a compromise between these two extreme positions may be the best conclusion that can be drawn from the data. Empirical support for this possibility has been published in a study by Fuld (1976) utilizing Buschke's restricted reminding procedure which found that Korsakoff patients exhibited deficits in both the long-term storage and retrieval of verbal information. Additional support for this possibility may be provided by the results from this study which found both storage and retrieval deficits in nonKorsakoff alcoholics if one assumes that the deficits of the nonKorsakoff chronic alcoholic who has maintained sobriety for approximately two weeks or less are similar in type to those of the Korsakoff patient. Obviously, further research utilizing Buschke's restricted reminding procedure with a large group of Korsakoff alcoholics would provide more meaningful data regarding this issue.

LTVM Deficits of the Left Temporal Damaged Group

The left temporal damaged group was found to be significantly different from the left damaged control group on all scores from both forms except total intrusions. Consequently, the LTVM deficits of the left temporal damaged group are quite similar to those of the chronic alcohol abuse group.

When compared to the left damaged control group, the left temporal damaged group had fewer retrievals, fewer consistent retrievals regardless of the number of consecutive trials specified, fewer retrievals on trial 12, and more re-presentations of the list words, suggesting a problem with the long-term storage or the long-term retrieval of verbal information or both. Data from the other scores from both forms revealed that the left temporal damaged group had deficits in both the storage and retrieval of verbal information from LTM since they had significantly fewer words stored in LTM and significantly lower percentages of words in LTM which were retrieved consistently. Thus, Buschke's test was able to provide data regarding the general LTVM deficits of the left temporal damaged group and a description of these LTVM deficits in terms of the long-term storage and retrieval of verbal information.

The significant verbal memory deficits of this group which were found in the present study are consistent with those general verbal memory deficits which have been reported in conjunction with damage to the left temporal and/or left subcortical regions of the brain (Brooks, 1972, 1974b; Inglis, 1970; Luria, 1973, 1976; Milner, 1958, 1970; Russell and Nathan, 1946; Schacter and Crovitz, 1977; Winocur and Weiskrantz, 1976). Moreover, the fact that LTVM deficits were found is consistent with data provided by Brooks (1975), Luria (1973, 1976), and Milner (1970) which demonstrated that general LTVM deficits arise with damage to these areas of the brain. The deficits in the long-term storage and the long-term retrieval of verbal information which were found in this study are partially in accord with the results from research with general amnesic patients which has shown that these brain-damaged patients have long-term retrieval deficits (Weiskrantz and Warrington, 1975). However, more research utilizing Buschke's test must be done before any definitive conclusions can be drawn as to the types of LTVM deficits found with patients who have sustained damage to the left temporal and/or left subcortical regions of the brain.

Comparison of the LTVM Deficits of the Chronic Alcohol Abuse Group and the Left Temporal Damaged Group

No overall significant difference was found between the chronic alcohol abuse group and the left temporal damaged group on the scores from either form of Buschke's test. This finding suggests that the memory functioning of the average chronic alcohol abuse *S* prior to a sustained period of sobriety is quite similar to the memory functioning of the average left temporal damaged *S*. This finding does not suggest that all alcoholic *S*'s were similar to all left temporal damaged *S*'s in their LTVM functioning. In fact, when individual scores from *S*'s from both groups were analyzed, four of the left temporal damaged *S*'s were found to be considerably more impaired than any of the chronic alcohol abuse *S*'s. Thus, it would be erroneous to conclude from the finding of no difference that an individual with LTVM deficits secondary to chronic alcohol abuse would necessarily perform as would an individual with LTVM deficits secondary to some other form of damage to the left temporal and/or left subcortical areas.

LTVM Deficits of a Chronic Alcohol Abuse *S* and a Left Temporal Damaged *S*

Scores from the food form for the chronic alcohol abuse *S* revealed that the *S* had significant LTVM deficits since all scores but WLTM fell within the memory-impaired range. He was found to have general LTVM deficits due to his poor scores on total retrievals, total re-presentations, retrievals on trial 12, and consistent retrievals. These general LTVM deficits were found to result from a retrieval deficit and not from a storage deficit since the S's percentages of words in LTM which were consistently retrieved fell in the impaired range while his number of words stored in LTM fell in the intact range.

Scores from the left temporal damaged S demonstrated that the S had extremely severe LTVM deficits since all of his scores were considerably worse than both the cut-off scores and the scores of the chronic alcohol abuse S. This S was found to have severe general LTVM deficits which were accounted for by both deficits in the long-term storage and the long-term retrieval of verbal information. However, the retrieval deficit was found to be more severe than the storage deficit since the S was able to retrieve only one list word on trial 12 despite having 9 words stored in LTM. Moreover, this deficit was found to stem primarily from interference from other verbal material stored in LTM since the S's intrusions outnumbered his retrievals.

Thus, the descriptions provided by the scores from Buschke's test of the two individual S's demonstrates the applicability of Buschke's restricted reminding procedure in evaluating an individual's LTVM functioning since this instrument provides not only a general assessment but also a detailed analysis of an individual's LTVM functioning in terms of storage and retrieval. Inspection of the scores of the two memory-impaired S's also demonstrates that the ranges of scores generated by the test permit sufficient variability so that meaningful comparisons can be made between the performance of different memory-impaired individuals.

Conclusion

Buschke's restricted reminding procedure appears to fill a void in clinical verbal memory testing since it provides meaningful data regarding LTVM functioning in terms of the storage and retrieval of verbal information. Moreover, it appears to be a reliable and valid test of LTVM functioning and has clinical utility since it is capable of providing detailed descriptions of the LTVM deficits of individual patients.

However, whether or not at present the test should be included in the clinician's armamentarium for assessing verbal memory functioning is debatable. Ideally, with any test which is being evaluated for use with clinical populations, an extensive amount of research regarding the test's reliability, validity, and clinical utility should be done prior to its adoption as a clinical instrument. In practice, however, as can be seen in the review of the clinical verbal memory tests, these rigorous standards are not followed prior to the test's adoption and use with clinical populations.

When a comparison is made between the results of this study on Buschke's test and the results obtained from studies on the clinical verbal memory tests, it is quite obvious that the psychometric properties of Buschke's test have been as well established as the psychometric properties of many of the clinical tests. Moreover, when a comparison is made between the detailed data that is provided by Buschke's test and by the clinical tests regarding verbal memory functioning, it is quite apparent that Buschke's test is far superior to the other tests.

Therefore, if the same relaxed standards were applied to Buschke's test as have been applied to the clinical verbal memory tests, Buschke's test would be accepted as a clinical test while if the ideal rigorous standards were applied, his test would still be viewed as experimental. In the case of Buschke's test since it appears to be a valuable tool in assessing LTVM functioning, the most appropriate course of action is to compromise between these extremes and to accept Buschke's restricted reminding procedure as a clinical test of LTVM while continuing to collect data to establish further its psychometric properties.

APPENDIX A
FREQUENCY OF USAGE PER MILLION WORDS FOR LIST WORDS FROM BUSCHKE'S ANIMAL FORM AND TODD'S FOOD FORM

Animal Form	Frequency of Usage*	Food Form	Frequency of Usage*
dog	100	milk	100
fox	25	lemon	27
horse	100	egg	100
buffalo	19	strawberry	19
lion	> 50 but < 100	bread	> 50 but < 100
rhinoceros	4	radish	4
elephant	35	cherry	35
antelope	7	cookie	7
bear	100	sugar	100
lamb	45	cheese	45
rat	37	olive	34
raccoon	1	avocado	1
sheep	> 50 but < 100	apple	> 50 but < 100
llama	1	broccoli	1
goat	> 50 but < 100	cake	> 50 but < 100
cheetah	**	frijole	**
squirrel	24	lime	27
beaver	23	plum	23
donkey	16	cabbage	16
turtle	13	banana	13

* as determined by Thorndike and Lorge (1944)
** less than 1 time per 4 million

APPENDIX B
SATZ-MOGEL DESIGN OF SHORT-FORM WAIS FOR VIQ

Subtest	Items Used	Multiply Score By
Information*	Every third item	3
Comprehension	Odd items only	2
Arithmetic	Odd items only	2
Similarities	Odd items only	2
Digit span	Unchanged	1
Vocabulary	Every third item	3

* Subtract one point from obtained scaled score

APPENDIX C

INSTRUCTIONS TO S'S PRIOR TO ADMINISTRATION OF EITHER FORM OF BUSCHKE'S TEST

The following instructions were given by the examiner to each S regardless of his classification prior to the administration of either form of Buschke's test: "You are about to be given an experimental verbal memory test which will assess your ability to remember verbal material. The test consists of 20 words that you will be asked to recall in any order that you wish over a series of 12 trials. The test may be difficult and frustrating for you and may be tiring since it takes about 20 minutes to complete. All that I ask is that you do the best that you can. When I first read you the words, I want you to repeat them so that I know that you heard them. After I give you the last word and you repeat it, I will tell you to recall as many of the words that you can in any order. Are there any questions?"

REFERENCES

Allen, R.P., Faillace, L.A. and Reynolds, D.M. Recovery of memory functioning in alcoholics following prolonged intoxication. Journal of Nervous and Mental Disease, 1971, 153, 417-423.

Allen, R.P., Faillace, L.A. and Wagman, A. Recovery time for alcoholics after prolonged intoxication. Johns Hopkins Medical Journal, 1971, 128, 158-164.

Anastasi, A. Psychological Testing. Toronto: Macmillan Company, 1968.

Bachrach, H. and Mintz, J. The Wechsler Memory Scale as a tool for the detection of mild cerebral dysfunction. Journal of Clinical Psychology, 1974, 30, 58-60.

Bennett, A.E. Alcoholism and the brain. New York: Stratton Intercontinental Medical Book Corp., 1977.

Binder, L.M. Recovery of information learning capability in chronic alcohol abusers after cessation of alcohol use. M.A. Thesis, Wayne State University, 1976.

Bloom, B.L. Comparison of the alternate Wechsler Memory Scale forms. Journal of Clinical Psychology, 1959, 15, 72-74.

Brooks, D.N. Memory and head injury. Journal of Nervous and Mental Disease, 1972, 155, 350-355.

Brooks, D.N. Recognition memory after head injury: A signal detection anlaysis. Cortex, 1974, 10, 224-230. (a)

Brooks, D.N. Recognition memory and head injury. Journal of Neurology, Neurosurgery, and Psychiatry, 1974, 37, 794-801. (b)

Brooks, D.N. Long and short term memory in head injured patients. Cortex, 1975, 11, 329-340.

Buschke, H. Selective reminding for analysis of memory and learning. Journal of Verbal Learning and Verbal Behavior, 1973, 12, 543-550.

Buschke, H. Spontaneous remembering after recall failure. Science, 1974, 184, 579-581.

Buschke, H. Retrieval of categorized items increases without guessing. Bulletin of the Psychonomic Society, 1975, 5, 71-73.

Buschke, H. and Fuld, P.A. Evaluating storage, retention, and retrieval in disordered memory and learning. Neurology, 1974, 24, 1019-1025.

Butters, N. and Cermak, L. Some analyses of amnesic syndromes in brain-damaged patients. In R.L. Isaacson and K.H. Primbram (Eds.), The Hippocampus: Volume 2. Neurophysiology and Behavior. New York: Plenum Press, 1975.

Butters, N., Cermak, L.S., Montgomery, B.A. and Aldinolfi, A. Some comparisons of the memory and visuoperceptive deficits of chronic alcoholics and patients with Korsakoff's Disease. Alcoholism: Clinical and Experimental Research, 1977, 1, 73-80.

Butters, N., Samuels, I., Goodglass, H., and Brody, B. Short-term visual and auditory memory disorders after parietal and frontal lobe damage. Cortex, 1970, 6, 440-459.

Caird, W.K., Sanderson, R.E. and Inglis, J. Cross validation of a learning test for use with elderly psychiatric patients. Journal of Mental Science, 1962, 108, 368-370.

Cermak, L.S., Butters, N. and Gerrein, J. The extent of the verbal encoding ability of Korsakoff patients. Neuropsychologia, 1973, 11, 85-94.

Cohen, J. Wechsler Memory Scale performance of psychoneurotic, organic, and schizophrenic groups. Journal of Consulting Psychology, 1950, 14, 371-375.

Craik, F.I.M. and Levy, B.A. The concept of primary memory. In W.K. Estes (Ed.), Handbook of learning and cognitive processes: Attention and memory. Vol. 4. Hillsdale, N.J.: Lawrence Erlbaum Associates, 1976.

Craik, F.I.M. and Masani, P.A. Age differences in the temporal integration of language. British Journal of Psychology, 1967, 58, 291-299.

Davis, L.J. and Swenson, W.M. Factor analysis of the Wechsler Memory Scale. Journal of Consulting and Clinical Psychology, 1970, 35, 430.

De Renzi, E. Nonverbal memory and hemispheric side of lesion. Neuropsychologia, 1968, 6, 181-189.

Dreyfus, P.M. Diseases of the nervous system in chronic alcoholics. In B. Kissin and H. Begleiter (Eds.), The Biology of Alcoholism: Volume 3. Clinical Pathology. New York: Plenum Press, 1974.

Ellenberg, L. Verbal and visuospatial impairment in chronic alcoholics. M.A. Thesis, Wayne State University, 1975.

Erickson, R.C. Problems in clinical memory testing. In D. Arenberg (Chair), Toward comprehensive intervention programs for memory problems among the aged. Symposium presented at the meeting of the American Psychological Association, San Francisco, 1977.

Erickson, R.C. and Scott, M.L. Clinical memory testing: A review. Psychological Bulletin, 1977, 84, 1130-1149.

Fedio, P. and Mirsky, A. Selective intellectual deficits in children with temporal lobe or centrencephalic epilepsy. Neuropsychologia, 1969, 7, 287-300.

Fuld, P.A. Storage, retention, and retrieval in Korsakoff's syndrome. Neuropsychologia, 1976, 14, 225-236.

Hall, J.C. and Toal, R. Journal of Consulting Psychology, 1957, 21, 131-135.

Howard, A. Diagnostic value of the Wechsler Memory Scale with selected groups of institutionalized patients. Journal of Consulting Psychology, 1950, 14, 376-380.

Hummell, T. and Sligo, J. Empirical comparisons of univariate and multivariate analyses of variance. Psychological Bulletin, 1971, 76, 49-57.

Inglis, J. An experimental study of learning and memory function in elderly psychiatric patients. Journal of Mental Science, 1957, 103, 796-803.

Inglis, J. A paired-associate learning test for use with elderly psychiatric patients. Journal of Mental Science, 1959, 105, 440-443. (a)

Inglis, J. Learning, retention, and conceptual usage in elderly patients with memory disorder. Journal of Abnormal and Social Psychology, 1959, 59, 210-215. (b)

Inglis, J. Memory disorder. In C. Costello (Ed.), Symptoms of psychopathology. New York: John Wiley, 1970.

Inglis, J., Shapiro, M. and Post, F. "Memory function" in psychiatric patients over sixty, the role of memory in tests discriminating between "functional" and "organic" groups. Journal of Mental Science, 1956, 102, 589-598.

Jonsson, C.O., Cronholm, B. and Izikowitz, S. Intellectual changes in alcoholics: Psychometric studies of mental sequels of prolonged intensive abuse of alcohol. Quarterly Journal of Studies on Alcohol, 1962, 23, 221-224.

Kear-Colwell, J.J. The structure of the Wechsler Memory Scale and its relationship to "brain damage." British Journal of Social and Clinical Psychology, 1973, 12, 384-392.

Kear-Colwell, J.J. The structure of the Wechsler Memory Scale: a replication. Journal of Clinical Psychology, 1977, 33, 483-485.

Kendrick, D.C., Parboosingh, R.C. and Post, F. A synonym learning test for use with elderly psychiatric subjects: A validation study. British Journal of Social and Clinical Psychology, 1965, 4, 63-71.

Kimura, D. Right temporal lobe damage: Perception of unfamiliar stimuli after damage. Archives of Neurology, 1963, 8, 264-271.

Kljajic, I. Wechsler Memory Scale indices of brain pathology. Journal of Clinical Psychology, 1975, 31, 668-670.

Luria, A.R. The Working Brain. New York: Basic Books, Inc., 1973.

Luria, A.R. The Neuropsychology of Memory. Washington, D.C.: V.H. Winston and Sons, 1976.

Meyer, V. and Yates, A.J. Intellectual changes following temporal lobectomy for psychomotor epilepsy. Journal of Neurology, Neurosurgery, and Psychiatry, 1955, 18, 44-52.

Milner, B. Psychological defects produced by temporal lobe excision. The Brain and Human Behavior, 1958, 36, 244-257.

Milner, B. Brain mechanisms suggested by studies of temporal lobes. In F.L. Darley (Ed.), Brain Mechanisms underlying Speech and Language. New York: Grune and Stratton, 1967.

Milner, B. Visual recognition and recall after right temporal lobe excision in man. Neuropsychologia, 1968, 6, 191-210.

Milner, B. Memory and the medial temporal regions of the brain. In K.H. Primbram and D.E. Broadbent (Eds.), The Biology of Memory. New York: Academic Press, 1970.

Mogel, S. and Satz, P. Abbreviation of the WAIS for clinical use: an attempt at validation. Journal of Clinical Psychology, 1963, 19, 288-291.

Newcombe, F. and Steinberg, B. Some aspects of learning and memory function in older psychiatric patients. Journal of Gerontology, 1964, 19, 490-493.

Newman, J. Wechlser Memory Scale. In O.K. Buros (Ed.), Fourth mental measurements yearbook. Highland Park, N.J.: Gryphon Press, 1953.

Ommaya, A.K. and Gennarelli, T.A. Cerebral concussion and traumatic unconsciousness: Correlation of experimental and clinical observations on blunt head injuries. Brain, 1974, 97, 633-654.

Parker, J.W. The validity of some current tests for organicity. Journal of Consulting Psychology, 1957, 21, 425-428.

Parsons, O.A. and Prigatano, G.P. Memory functioning in alcoholics. In I.M. Birnbaum and E.S. Parker (Eds.), Alcohol and Human Memory. New York: John Wiley and Sons, 1977.

Penfield, W. and Roberts, L. Speech and Brain Mechanisms. Princeton: Princeton University Press, 1959.

Prigatano, G.P. Wechsler Memory Scale is a poor screening test for brain dysfunction. Journal of Clinical Psychology, 1977, 33, 772-777.

Reynolds, G.E. Memory functions in temporal lobe epileptics: Comparison between groups with right and left unilateral foci. Dissertation, University of Florida, 1974.

Riddell, S.A. The performance of elderly psychiatric patients on equivalent forms of tests of memory and learning. British Journal of Social and Clinical Psychology, 1962, 1, 70-71. (a)

Riddell, S.A. The relationships between tests of organic involvement, memory impairment, and diagnosis in elderly psychiatric patients. British Journal of Social and Clinical Psychology, 1962, 1, 228-231. (b)

Russell, E.W. A multiple scoring method for the assessment of complex memory functions. Journal of Consulting and Clinical Psychology, 1975, 43, 800-809.

Russell, W.R. and Nathan, P.W. Traumatic amnesia. Brain, 1946, 69, 280-300.

Samuels, I., Butters, N. and Fedio, P. Short term memory disorders following temporal lobe removals in humans. Cortex, 1972, 8, 283-298.

Samuels, I., Butters, N. and Goodglass, H. Visual memory deficits following cortical and limbic lesions: Effect of field of presentation. Physiological Behavior, 1971, 6, 447-452.

Satz, P. A test of some models of hemispheric speech organization in left- and right-handers. Science, In press.

Satz, P. and Mogel, S. An abbreviation of the WAIS for clinical use. Journal of Clinical Psychology, 1962, 18, 77-79.

Schacter, D.L. and Crovitz, H.F. Memory function after closed head injury: A review of the quantitative research. Cortex, 1977, 13, 150-176.

Schepers, J.M. The assessment of brain damage from a psychometric point of view. Forensic Science, 1972, 1, 269-311.

Shapiro, M.B. and Nelson, E.H. An investigation of the nature of cognitive impairment in cooperative psychiatric patients. British Journal of Medical Psychology, 1955, 28, 239-256.

Shapiro, M.B., Post, F., Lofving, B. and Inglis, J. "Memory function" in psychiatric patients over sixty, some methodological and diagnostic implications. Journal of Mental Science, 1956, 102, 233-246.

Sharp, J.R., Rosenbaum, G., Goldman, M.S. and Whitman, R.D. Recoverability of psychological functioning following alcohol abuse: Acquisition of meaningful synonyms. Journal of Consulting and Clinical Psychology, 1977, 45, 1023-1028.

Shontz, F.C. Evaluation of intellectual potential in hemiplegic individuals. Journal of Clinical Psychology, 1957, 13, 267-269.

Stone, C.P., Girdner, J. and Albrecht, R. An alternate form of the Wechsler Memory Scale. Journal of Psychology, 1946, 22, 199-206.

Talland, G.A. Deranged Memory. New York: Academic Press, 1965.

Thorndike, E.L. and Lorge, I. The Teacher's Word Book of 30,000 Words. New York: Teacher's College Press, 1944.

Victor, M., Adams, R.D. and Collins, H.G. The Wernicke-Korsakoff Syndrome. Philadelphia: F.A. Davis Company, 1971.

Walton, D. The diagnostic and predictive accuracy of the Modified Word Learning Test in psychiatric patients over 65. Journal of Mental Science, 1958, 104, 1119-1122.

Walton, D. and Black, D.A. The validity of a psychological test of brain damage. British Journal of Medical Psychology, 1957, 30, 270-279.

Walton, D., White, J.G., Black, D.A. and Young, A.J. The Modified Word-Learning Test: A cross validation study. British Journal of Medical Psychology, 1959, 32, 213-220.

Wechsler, D. A standardized memory scale for clinical use. Journal of Psychology, 1945, 19, 87-95.

Weingartner, H., Faillace, L.A. and Markley, H.G. Verbal information retention in alcoholics. Quarterly Journal of Studies on Alcohol, 1971, 32, 293-303.

Weiskrantz, L. and Warrington, E. The problem of the amnesic syndrome in man and animals. In R.L. Isaacson and K.H. Primbram (Eds.), The Hippocampus: Volume 2. Neurophysiology and Behavior. New York: Plenum Press, 1975.

White, J.G., Merrick, M. and Harbison, J.J. Williams Scale for the Measurement of Memory: Test reliability and validity in a psychiatric population. British Journal of Social and Clinical Psychology, 1969, 8, 141-151.

Williams, M. The measurement of memory in clinical practice. _British Journal of Social and Clinical Psychology_, 1968, _7_, 19-34.

Winocur, G. and Weiskrantz, L. An investigation of paired-associate learning in amnesic patients. _Neuropsychologia_, 1976, _14_, 97-110.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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Professor of Clinical Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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